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TRANSACTIONS AND PROCEEDINGS

AND

REPORT

OF THE

ROYAL SOCIETY OF SOUTH AUSTRALIA

(LATE ADELAIDE PHILOSOPHICAL SOCIETY).

VOL. III.

(FOR 1879-80.)

Adelaide:
G. ROBERTSON, 103, KING WILLIAM STREET.

1880.

Royal Society of South Australia.

Patron:
HER MAJESTY THE QUEEN.

Vice-Patron:
HIS EXCELLENCY SIR W. F. D. JERVOIS, G.C.M.G., C.B., &c.

OFFICERS

[ELECTED OCTOBER 5, 1889.]

President:
HIS HONOR S. J. WAY, CHIEF JUSTICE.

Vice-Presidents:
F. CHAPPLE, Esq., B.A., B.Sc.
CHARLES TODD, Esq., C.M.G., F.R.A.S., &c.

Hon. Secretary:
WALTER RUTT, Esq., C.E.

Hon. Treasurer:
THOMAS D. SMEATON, Esq.

Members of Council:

D. B. ADAMSON, Esq.
F. CHAPPLE, Esq., B.A., B.Sc.
S. J. MAGAREY, Esq., M.B.
WALTER RUTT, Esq., C.E.
THOMAS D. SMEATON, Esq.
PROF. R. TATE, F.G.S., &c., (Natural Science Director).
J. D. THOMAS, Esq., M.D.
HIS HONOR S. J. WAY, Esq., C.J.
CHARLES TODD, Esq., C.M.G., F.R.A.S., &c. (REPRESENTATIVE GOVERNOR.)

Assistant Secretary:
MR. A. MOLINEUX.

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LIST OF FELLOWS, MEMBERS, &c.,

November 2nd, 1880.

Those marked (F) were present at the first meeting when the Society was founded. Those marked (L) are Life Fellows. Those marked with an asterisk have contributed papers.

		Date of Election.
HONORARY MEMBERS.		
Angas, Geo. French, F.L.S., C.M.Z.S.	Norland-square, London ..	1879
Barkely, Sir Henry, G.C.M.G., K.C.B.	.. .. ..	1857
Ellery, R. L. J., F.R.S.	Observatory, Melbourne ..	1876
*(F) Feignagle, C. G.	Melbourne	1853
*Garran, A., L.L.D.	Sydney	1853
*Hull, H. M.	Hobart Town	1855
Jervois, H. E. Sir W. F. D., G.C.M.G., C.B.	Government House ..	1878
Little, E.	.. .. ..	1855
Macleay, W., F.L.S.	Sydney	1878
Russell, H. C., B.A., F.R.A.S. ..	Observatory, Sydney ..	1876
Von Mueller, Baron Ferd., K.C.M.G., F.R.S.. &c.	Melbourne	1879
Warburton, Col. P. Egerton ..	Beaumont	1858
*Wilson, C. A.	Supreme Court	1853
*Woods, Rev. J. E. T., F.L.S., F.G.S., &c.	Sydney	1877
(F) Young, J. L.	Parkside	1853
CORRESPONDING MEMBERS.		
Canham, J.	Stuart's Creek	1880
Foelsche, Paul	Palmerston	1880
*Hayter, H. H., F.S.S.	Government Statist, Melbourne	1878
Richards, Mrs. A.	Fowler's Bay	1880
*Scoular, Gavin	Blair, Smithfield	1878
*Tepper, J. G. Otto	Ardrossan, Yorke's Peninsula	1878
FELLOWS.		
*Adamson, D. B.	Angas-street	1867
Addis, W. L.	Currie-street	1879
Angas, J. H.	Collingrove, Angaston ..	1874
Biggs, Col. J. H.	Edwardstown	1878
Brunskill, George, J.P.	Morgan	1878
*Chalwin, Thomas	Currie-street	1877
Chapple, F., B.A., B.Sc.	Prince Alfred College ..	1876
Clelard, R., M.D.	Parade, Norwood	1879
*(L) Cooke, E., M.P.	South-terrace	1876
Cox, W. C.	Buxton-street, North Adelaide	1880
Crawford, F. S.	Surveyor-General's Office ..	1865
*Davenport, S.	Beaumont	1856
Davidson, Rev. Professor, University of Adelaide	Jeffcott-street, N. Adelaide ..	1876
Dobbie, A. W.	Gawler-place	1876

Duffield, W.	Gawler	1859
Elder, Sir Thomas	Grenfell-street	1871
*Fletcher, Rev. W. R., M.A., ..	North-terrace, Kent Town ..	1876
Gall, D.	Tynte-street, N. Adelaide ..	1865
Gaze, W. H., M.D.	Parade, Norwood	1880
Giles, E. W.	Government Offices ..	1877
*(F) Gosse, William, M.D., F.R.C.S.	North-terrace	1853
Gosse, Chas., M.D.	North-terrace	1877
*Hamilton, George, Commissioner of Police	Adelaide Club	1868
Harrold, Arthur L.	Hindley-street	1876
Harry, Thos.	Exchange..	1878
Hay, Hon. Alexander, M.L.C. ..	Beaumont	1861
Hickson, R., M.I.C.E.	Semaphore	1876
*Hill, W.	Kensington-road	1874
Hopkins, Rev. W.	Glenelg	1880
Hull, W. B., C.E., Assistant Hydraulic Engineer	Hydraulic Engineer's Office..	1874
Hullett, J. W. H., C.E.	Port Augusta	1876
*Ingleby, R., Q.C.	King William-street ..	1861
Johnson, J. A.	Alfred Chambers, Currie-street	1875
*Joyce, J. F., M.D.	South-terrace	1880
*(F) Kay, R., Secretary South Australian Institute	College Town	1853
Knevett, S.	Carrington-street	1878
*Laughton, E.	Currie-street	1874
*Lloyd, J. S.	Lefevre-terrace, N. Adelaide..	1856
*Macgeorge, Jas.	King William-street ..	1855
Madley, L. G., Principal of Training College	Moonta-street	1879
Magarey, A. T.	Barton-terrace, N. Adelaide ..	1873
*Magarey, S. J., M.B.	North-terrace	1874
Mayo, G., M.D.	Morphett-street	1853
Mayo, G. G., C.E.	Engineer-in-Chief's Office ..	1874
(L) Murray, David	Hutt-street	1859
Nesbit, E. P., Jun.	King William-street ..	1875
Nesbit, W. P., M.D.	North Adelaide	1880
*Ponton, T. G., F.Z.S.	.. .. ..	1877
Rees, John, M.D.	Port-road, Hindmarsh ..	1880
Rees, Rowland, M.P., C.E. ..	Waymouth-street	1874
Russell, W.	Commercial-rd., Port Adelaide	1879
*Rutt, Walter, C.E.	Engineer-in-Chief's Office ..	1869
*Schomburgk, R., Doctor Ph., &c. Director	Botanic Gardens	1865
*Smeaton, T. D.	Bank of South Australia ..	1857
Smith, R. Barr	Torrens Park, Mitcham ..	1871
Smith, William, C.E.	Hydraulic Engineer's Office ..	1880
Sparks, H. Y.	Glenelg	1878
Strother, C. H., C.E.	Engineer-in-Chief's Office ..	1880
Stuckey, J. J., M.A.	Victoria Chambers, King William-street	1878
*Tate, Prof. Ralph, F.G.S., University of Adelaide	Buxton-street, N. Adelaide ..	1876
Telfer, W.	Wallaroo Hospital	1880
Thomas, J. Davies, M.D. ..	North-terrace	1877
Thomas, R. G., Sec. of Board of Health	Unley	1877
Thow, W., Locomotive Engineer ..	S.A. Railways	1878

Todd, Charles, C.M.G., F.R.A.S., M.S.T.E., Postmaster-General, Observer, and Superintendent of Telegraphs	Observatory	1856
Tomkinson, S.	Mount Lofty	1876
Townsend, W., M.P.	King William-street ..	1878
Umbehaun, C.	General Post Office ..	1879
*Verco, Joseph C., M.D.	Wellington-square, N. Adelaide	1878
Vickery, G.	Meadows	1868
Ware, W. L.	Victoria Chambers, King William-street	1878
*Waterhouse, F. G., C.M.Z.S., &c., Curator of Museum	S. A. Institute	1859
Way, His Honor, S. J., C.J. ..	North Adelaide	1859
Way, E. W., M.R.C.S.	North-terrace	1878
Wragge, C. L., F.R.G.S.	Care of R. Ingleby, King William-street	1877
Wyatt, Wm., M.D.	Burnside	1859
ASSOCIATES.		
Holder, Sydney E.	Parade, Norwood	1880
Rogers, R. S.	Bailey's Gardens, Hackney ..	1880
*Smeaton, Stirling	Menindie	1878

RULES.

WHEREAS "The Royal Society of South Australia" is incorporated with the South Australian Institute, under the provisions of the South Australian Institute Act, 1863, and it is desirable to consolidate and alter the Rules and Regulations at present existing, it is therefore agreed that the Society shall be governed by the following Rules and Regulations, to the exclusion of all previous Rules and Regulations:—

1. The title of the Society is "THE ROYAL SOCIETY OF SOUTH AUSTRALIA."

2. The objects of this Society are the diffusion and advancement of the arts and sciences, by the meeting together of the members for the reading and discussion of papers connected with the above subjects, and by other approved means.

3. The Society shall consist of the present members, and of such persons as shall be hereafter elected members.

4. The members shall be classed as follows:—Fellows, Honorary Members, Corresponding Members, and Associates, all of whom shall be elected by ballot.

5. The Sovereign shall be the Patron, and His Excellency the Governor of South Australia for the time being shall be requested to be the Vice-Patron of the Society.

FEES.

6. Fellows shall subscribe £1 1s. per annum, payable in advance on the 1st day of November to the Honorary Secretary.

7. A Fellow may at any time compound for future annual contributions, that of the current year exclusive, by the payment of the sum of £10 10s.

8. Fellows elected during the first half of the financial year shall, within one month after election, pay the full annual subscription of one guinea; but if elected during the second half of the year, they shall pay the sum of half a guinea only as subscription for the remainder of the financial year.

9. Any person who has not paid the year's contribution on or before the 1st day of January shall be liable to have his name removed by the Council from the list of members of the Society; provided always, that written application for the same shall first have been made by or on behalf of the Treasurer; and pro-

vided also, that the Council shall have power to restore the defaulter's name at his request, and after payment of arrears.

Election of Fellows.

10. Every election of a Fellow into the Society shall take place at an ordinary meeting only.

11. Every candidate for admission into the Society must be recommended by two members. The certificate setting forth the names, address, and occupation of the candidate, with the names of his proposer and seconder, shall be sent to the Secretary, and shall be read at a meeting of Council, and also at the following meeting of the Society, and the ballot shall take place at the next following ordinary meeting of the Society.

12. The election of Fellows shall be by ballot, one negative in six excluding; and no candidate having been excluded shall be again proposed for admission during the current year.

13. Persons elected shall have immediate notice thereof transmitted to them by the Secretary, accompanied by a copy of the Rules.

14. Fellows shall have a right to vote at all meetings and to propose candidates for admission into the Society and into the Council of the Society, subject to the Rules touching the election and constitution of the Society. They shall be eligible to be members of the Council, shall have access to the Library, and shall be furnished with a copy of any transactions, proceedings, or journal which may be published by the Society.

Honorary and Corresponding Members.

15. The Honorary Members shall be persons distinguished for their attainments in science, literature, or art.

16. The Corresponding Members shall be persons residing beyond ten miles from Adelaide, who, by furnishing papers or otherwise, may have promoted the objects of the Society.

17. Every person proposed as an Honorary or Corresponding Member shall be recommended by the Council, and be balloted for as in the case of Fellows.

18. Honorary and Corresponding Members shall be exempted from payment of fees; they may exercise the privileges or perform the duties of Fellows, except that they shall not vote or otherwise interfere in the business of the Society, or hold office or seat on the Council.

Associates.

19. Associates shall consist of young men of not more than 21 years of age, and of ladies.

20. Associates shall subscribe 5s. per annum, payable in advance on the 1st day of November, to the Honorary Secretary.

21. The election of Associates shall be after the same manner as in the case of Fellows.

22. Any Associate failing to pay his or her subscription within one month of notice of election, or who shall be three months' in arrear with his or her subscription, shall cease to be an Associate.

23. Associates shall enjoy all the privileges of Fellows except those of taking part in the management of the affairs of the Society, of voting, and of introducing visitors.

24. Any Associate shall be entitled to become a Fellow of the Society at the first ordinary meeting following the receipt of his application for Fellowship.

Local Correspondents.

25. Local Correspondents shall be persons willing to co-operate with the Society in recording Natural Science phenomena in this province, and shall be appointed by the Council. Such Correspondents shall not exercise the privileges of members, but shall be entitled to a copy of all approved communications from the Local Correspondents, which may be published by the Society.

Meetings.

26. Meetings of the Society shall be convened by circular to the members resident in the colony. The circular shall state the subjects to be brought before the meeting, the names of the candidates for membership, and any notice of motion.

27. Meetings of the Society to be held on days to be fixed by the Council; and as far as practicable one meeting shall be held in each month. Each meeting to commence at half-past 7 o'clock p.m.

28. The President, or in his absence one of the Vice-Presidents, shall take the chair; and in the event of the absence of all the above, the members present shall elect a Chairman.

29. The business of the Society's meetings shall be transacted in the following order, unless it be specially decided otherwise:—

I. The reading and confirming the minutes of the last meeting.
II. The nomination of candidates for membership and the election of members.
III. Vacancies among officers, if any, to be filled up.
IV. The transaction of the ordinary business.
V. Motions to be considered, and notices of motion for next meeting to be read.
VI. The consideration of any special matters which members may desire to bring forward subject to the ap-

proval of the chairman obtained before the commencement of the meeting.

VII. At 8 o'clock the paper or subject notified in the circular shall be read.

30. Any Fellow shall be allowed to introduce two visitors upon entering their names in the Visitors' Book. But no visitor shall speak at a meeting of the Society unless specially invited to do so by the Chairman.

31. No paper shall be read at any meeting which has not been previously notified to the Council.

32. Every paper read before the Society shall be the property thereof, and immediately after it has been read shall be delivered to the Secretary and shall remain in his custody.

33. An annual general meeting of the members duly convened by circular shall be held in the month of October at half-past 7 o'clock in the evening, on such day as the Council may appoint. In the event of less than ten Fellows being present, it shall not be lawful for the meeting to proceed to business except for the purpose of adjournment, and the meeting shall stand adjourned to a day and time then resolved upon.

34. At the adjourned meeting the Fellows then present may proceed to business although ten Fellows may not be present.

35. The Council shall call a special meeting of the Society on receiving a requisition in writing, signed by ten Fellows of the Society, specifying the purpose for which the meeting is required, or upon a resolution of its own. No other business shall be entertained at such meeting. Notice of such meeting, and the purpose for which it is summoned, shall be sent to every member at least seven days before the meeting. Ten Fellows to form a quorum.

36. One Fellow, not being a member of the Council, shall be chosen at the meeting of the Society next before the month of October in each year as auditor of accounts and balance sheet of the Society, and shall examine and certify the same prior to the meeting in October.

The Council.

37. The officers of the Society shall be a President, two Vice-Presidents, a Treasurer, and a Secretary, who, with four other members, shall constitute the Council.

38. The Council, on its first meeting, shall appoint one of its members to represent the Society at the Board of Governors of the South Australian Institute, and one to act as Director of the Natural Science Correspondence Department.

39. The Council shall have the management of the affairs of the Society.

40. The Council shall meet once in every month for the

transaction of business at such time and place as may be appointed. Special meetings of the Council may be convened at any other time on the authority of the President, or of three members of the Council. Due notice of all Council meetings to be sent to each member.

41. No business shall be transacted at any meeting of the Council unless at least four members of the Council are present; in case of equality of votes the Chairman shall have an additional or casting vote.

42. It shall be the duty of the Council to decide on the papers to be read at the monthly meetings, whether by members or non-members; to determine as to the publication in whole or in part of any paper so read; to prepare a report of the proceedings of the Society for the preceding year, and a balance sheet of the Society's funds, for presentation at the meeting of the Society held in October; and generally to transact the ordinary affairs of the Society.

43. Any member of Council, personally interested in a question before the Council, shall withdraw during its consideration.

44. Every vacancy in the Council shall be immediately filled up at the next meeting of the Society by election by ballot. The member so elected shall occupy the place of the retiring member.

45. Any member of Council absenting himself from three consecutive ordinary meetings of the Council without satisfactory explanation shall be considered to have vacated office, and the election of a member to fill his place shall be proceeded with in accordance with Rule 44.

Election of Officers and Members of Council.

46. All officers and members of Council shall retire from office annually at the general meeting in October.

47. The officers and members of Council so retiring shall be eligible for the same or any other office.

48. The President, the two Vice-Presidents, the Treasurer, and the Secretary shall be separately elected by ballot (should such be demanded) in the above-named order, and the four vacancies in the Council shall be filled up together by ballot at the general meeting in October.

Secretary.

49. It shall be the duty of the Honorary Secretary to attend and take minutes of the proceedings of the Society and Council respectively; to make the necessary arrangements for meetings; to issue the required notices; to collect the annual subscriptions and to pay them to the Treasurer; to take charge of

all the property under the control of the Society; and generally to transact the ordinary routine business of the Society.

Treasurer.

50. It shall be the duty of the Treasurer to receive all funds belonging to the Society; to pay all accounts approved by the Council; and to render annually an account of all moneys received and expended during his year of office.

Natural Science Director.

51. It shall be the duty of the Director to conduct the correspondence with the Local Correspondents and Natural Science Referees; to report at the ordinary meetings of the Society all useful information therein contained; and to prepare the same for publication, subject to the approval of the Council.

Alteration of Rules.

52. The Rules and Regulations of the Society shall not be altered unless a written notice of motion, signed by not less than five Fellows, be given at a meeting of the Society; and thereupon such motion may be brought forward at the next meeting.

53. Any resolution passed as above altering or repealing the Rules and Regulations of the Society shall be in force until the meeting held in the month of October following; and, if not then confirmed, shall thereafter be held void and of no effect.

ABSTRACT OF PROCEEDINGS

OF THE

Royal Society of South Australia,

FOR 1879-1880.

ORDINARY MEETING, NOVEMBER 1, 1879.

Professor RALPH TATE, F.G.S., President, in the Chair.

The list of donations to the Library was read.

NOTES AND EXHIBITS.

Professor TATE said, in reference to the "Naturalised Weeds in South Australia," by Dr. Schomburgk, that he considered the list to be incomplete, as many aggressive weeds had been overlooked. Of these he mentioned particularly a species of *Diplotaxis*, a *Salvia*, *Chenopodium murale*, *Trifolium agrarium*, &c. Whilst on the other hand, undue prominence was given to such species as *Bellis perennis*, *Eschscholtzia californica*, &c., which in his opinion were no more than garden outcasts, and their existence to a large extent was dependent on man's protective agency. He thought such a work as that issued by the Doctor could hardly be successfully undertaken by one person single-handed; and he trusted that the Society would facilitate the future efforts of Dr. Schomburgk in that direction by encouraging observers in all parts of the colony to furnish records. With regard to the recorded occurrence of the indigenous plants of South Australia, he pointed out by reference to certain widely-dispersed species that the information given in the "Flora Australiensis" was very incomplete, and that several species are not mentioned at all. As an aid to the study of our native flora, he stated that he had made much progress towards a complete herbarium for the University, between 800 and 900 species being already mounted and named. The collection would always be accessible to those desirous of utilising it.

Professor TATE stated that he had very recently visited Ardrossan, and had examined, under the guidance of Mr.

Tepper, the fossiliferous rocks referred to by that gentleman in his paper published in last year's Transactions. He was happy to be able to confirm the principal statements made by Mr. Tepper. He also exhibited some fossils collected by himself from the Lower Silurian rocks, amongst them being a well-preserved head of a trilobite, which showed no trace of eyes.

Professor Tate exhibited specimens of three species of the pelagic molluse, *Ianthina*, which he had received from King George's Sound, through the kindness of Professor Davidson. The shells were in a fine state of preservation, and had evidently been taken alive, as the wet sand in which they were packed had been stained a rich violet hue by the colouring matter exuded from the animal.

Mr. T. D. Smeaton exhibited a number of small black insects which he had received from Jamestown. He explained that they were frequently found in cart-ruts. The body of these insects he had found to be oval, while they were furnished with antennæ. The eye was depressed and compound, and the body had a springing motion, but nevertheless it was probable that the animal was not a *Podurus*, as it had no spring-tail.

The following communication was read:—"On Red Rust." By Mr. J. G. Otto Tepper. (See p. 13.)

Ordinary Meeting, December 2, 1879.

Professor Ralph Tate, F.G.S., President, in the Chair.

Dr. W. L. Cleland was elected a Fellow.

The list of donations to the Library was read.

NOTES AND EXHIBITS.

Professor Tate read portions of a letter from Baron F. von Mueller in reference to the indigenous plants of South Australia, and he advised that the Society do solicit Baron F. von Mueller to prepare a revised list, giving more detailed information, especially in regard to localities, an item in which the "Flora Australiensis" was deficient.

Mr. Molineux exhibited specimens of *Aphrophora spumaria*, found abundantly on all kinds of plants in his garden at Kent Town. The perfect insect has pure white chalky-looking wingcases; the larvæ, in its first stage, is enveloped in the characteristic frothy liquid, but afterwards it became covered with a downy material like that of the "mealy-bug."

Mr. Thos. D. Smeaton exhibited a portfolio containing a large number of plants collected upon the River Darling.

The following communication was read "On the Medicinal

Uses of Wattle Bark (*Acacia pycnantha*)," by Dr. S. J. Magarey :—

[ABSTRACT.]

The golden or broad-leafed wattle *(Acacia pycnantha)* is found in abundance in this colony, especially upon undulating hills, thriving upon almost any soil, but preferentially on that of a light sandy nature. It exudes an abundance of gum, and affords what is now acknowledged to be "far and away the most valuable tanning bark in the world." Its higher branches and twigs yield some of the best bark. The sap is up during September to December, and hence these are the best months for collecting the bark, whether for economic or medicinal purposes. It is acknowledged that the tanning properties improve if the bark be kept for some little time. The wattle is at its prime when it is from eight to ten years, and in the hands of Mr. Bosisto it has yielded as much as 45 per cent. of tan extractive. Its main use in medicine is as an *astringent.* It corrugates the papillæ of the tongue, and imparts a decidedly astringent taste, it coagulates albuminous fluids, and causes contraction of muscular fibre. Its primary effect when applied to a mucous membrane is to diminish secretion; and there is no doubt that by diminishing the relaxation of the stomach and intestines it promotes digestion. It ranks high amongst the vegetable astringents, and the very finest qualities of Pegu catechu hardly exceed that of our wattle. As an astringent it has been exceedingly serviceable to me in my practice amongst infants and children. A form of diarrhœa exceedingly common amongst them, and very fatal, seems to be met more readily with this remedy than with any with which I am acquainted. It occurs most frequently during dentition during the summer months, especially in infants brought up by hand, but also under the most favourable circumstances as regards diet and nursing. The stools are exceedingly frequent, watery, usually green or almost colourless, not always accompanied by pain. But if unchecked, the child passes from this condition with a restless fretful disposition into that known as spurious hydrocephalus. I usually order an infusion, or prepare one at the house, by putting a piece of bark weighing from half a drachm to one drachm in a breakfast-cup two-thirds full of boiling water, covering it and letting it stand for an hour or two. I then direct a teaspoonful to be given every half-hour, or even oftener. For adults the dose requires to be much larger. Occasionally I have finely powdered the bark and triturated with sugar of milk. I think the infusion will at all times give more satisfaction than the tincture. There is a mistaken notion that it is unwise to check diarrhœa in infants, but I am inclined to think that the danger lies in failing to check it,

although it is better not to stop it suddenly. The infusion of *Acacia pycnantha* does not usually immediately arrest the diarrhœa. Errors in dieting must, of course, be corrected, and attention to hygienic requirements is necessary *in all* cases, or no remedy will be successful. In the winter-diarrhœa of infants I have not found the remedy to be so efficacious. It is useful in other forms of diarrhœa, but I do not think it should be used in any inflammatory conditions. In dysentery its effect is not so marked, and though useful, I think we have better remedies. In sore eyes, catarrhal ophthalmia, it is a favourite remedy in the country. I have used it with success in such cases. In a case of granular lids I think the patient benefited from its use, although under ordinary treatment his disease had remained stationary. *In true diphtheria* it is unreliable; but in those cases where there is a deposit upon the tonsils, diphtheric in character, but unaccompanied by the characteristic symptoms of blood-poisoning, it seems when used as a gargle or as a glycerole painted upon the pharynx and tonsils to be very useful. In sore throat, simple angina, it is valuable. It makes a fine gargle for relaxed throat, and more especially for that form of sore throat which is rendered less painful by eating a meal. I have mixed two drachms of the tincture with an ounce of glycerine, and have found a useful application for otorrhœa (running at the ears), for chapped lips, and slight fissures of various kinds. I have used it also in ozœna. It is very useful for sore nipples in nursing mothers. I do not think it is so useful in this form as the glycerine of tannic acid, but it makes an excellent substitute for it. In sweating feet, it is a good plan to steep them occasionally in a strong infusion of the bark. In typhoid fever it has on one or two occasions seemed to check what appeared to be an incipient attack. But we have a much better remedy in baptisin. I used it in one case of typhoid fever for hæmorrhage from the bowels with apparent success. The remedy ought to be useful in hæmoptysis (spitting of blood), hæmatemesis (vomiting of blood). It deserves a trial in all discharges from a mucous membrane, as leucorrhœa, &c., &c. I have been informed that the gum of the wattle, taken internally, is a useful remedy for piles. It is used in veterinary practice in the country for wounds and raw shoulders. I have tried it occasionally, and feel encouraged by the results. It is more generally of advantage in indolent ulcers and wounds that want a little gentle bracing-up. It is a good remedy for eczema where there is much weeping, and is really admirable for intertrigo (that is, the chafing of the skin of an infant) that occurs in the folds of the skin and about the nates. It ought to be useful for the arrest of venous hæmorrhage from the surface, but I have not yet given it a

trial. It may be objected that these ailments can be treated equally well with other astringents. This is not the case in all the instances referred to. But granting the truth of the statement, yet it is some advantage to know that we have at our doors so excellent a remedy. It has several other advantages besides being so easily obtained, it is not unpleasant to the palate, and there is seldom any difficulty in getting children to take it. The tincture, too, has a beautiful colour, an advantage not to be despised. It is not poisonous.

Mr. Molineux said that when he was a boy wattlebark was often used for opthalmic complaints, and some persons had been known to drink the tan-water at a tanyard to cure diarrhœa and dysentery, and it was found of benefit in cases of sore eyes.

Professor Tate asked if the natives used infusions of bark, because if they did the knowledge might be useful. He believed a doctor in Queensland was directing attention to the subject. As far as he knew, the natives seemed quite helpless in cases of illness.

Mr. T. Magarey said white gum was used by the aborigines, he believed, in certain complaints. He thought a great mistake was being made in attempting to substitute different trees in the Park Lands for trees such as the peppermint and white-gum and wattle that originally flourished there. If the Corporation would take the trouble to plant groves of wattles it would be found beneficial, as the gum was no doubt wholesome. Children eat it. Some simple remedies were very effectual, and often the primitive remedies used by old women were found to serve an excellent purpose. Old women were very useful, provided they were old women of the right sex.

Professor Tate initiated a discussion on the encouragement of natural history research in South Australia. He proposed a scheme for the systematic reception and record of facts relating to the natural history of the colony, and made suggestions as to the best means of stimulating the practical study of natural science. He said Mr. Lloyd, in 1866, very earnestly urged upon the attention of members the two fundamental objects of the Society, on which he remarked that its founders were desirous that it should not only afford an agreeable medium of intercommunication to those whose tastes led them to the pursuit of similar studies, but that it should also present a means of illustrating and recording the many interesting natural phenomena peculiar to the country, and which it was feared would be altogether, in a few years, irrevocably lost to the records of science. Six years later Mr. Smeaton submitted to the consideration of the Society some practical suggestions

by which it was thought those objects could best be obtained. No response seemed to have been given to the appeal. Now that the Society was better circumstanced, it should give effect to the abstract resolutions proposed in 1872. The time had arrived when the Society should make strenuous efforts in the direction indicated. By its widespread publications it offered to provincial workers a channel of intercommunication, and was prepared to adequately illustrate all original papers, when necessary, by lithographic plates. The healthy vigour of the Society must be to a large extent sustained by the efforts of those occupying themselves with the more technical aspects of science, but such workers needed coadjutors. The Society should endeavour to add recruits by stimulating a love for scientific pursuits. He had been brought to think deeply on the subject from discussions in the daily papers, originating in some remarks he made at the last meeting of the Society touching the occurrence of certain introduced plants into the colony. Regarding that matter, he read a letter from Mr. E. S. Wigg to the effect that he had been much amused at the correspondence in the *Register re* the *Leontodon taraxacum*. He introduced the seed twenty-five years ago, and gave Mr. Greenham, of Third Creek, some, who raised plants, and from him it had gone from Payneham to Bridgewater. He had grown it in his garden at North Adelaide for twenty-five years, chiefly for his cage-birds, who were very fond of it. He had been rather amused at Mr. McEwin's argument that Professor Tate must have made a mistake, as he " had not seen the plant in the colony." The remarks he (Professor Tate) had made had elicited unrecorded facts from no less than five individual observers, and proved that no large inquiry like that of the distribution of our alien plants could be exhaustively undertaken by one person acting independently. He proposed that observers should be encouraged to correspond with the Society ; facts should be recorded, published, or reserved ; there should be a Committee of Reference, and a Corresponding Secretary might be appointed to undertake duties connected with the reception of facts and specimens. If the scheme worked well it might be advisable to add to the Council a Director. Correspondents known to have facilities for gathering desiderated knowledge should have their attention particularly directed to the points about which more information was desired. For instance, Professor Owen has, for 35 years, been asking for information upon certain points in the generative economy of the *Echnida hystrix;* another question was, whether the porcupine ant-eater, inhabiting Kangaroo Island, was that species. The exhibition of specimens and reading of notes referring thereto was one means whereby members might be interested in

natural history work. Another stimulant would be excursions to the most interesting localities for investigating natural history, say two each year. Prizes for the best collection of scientific objects or the best paper might be made.

Mr. Smeaton said he cordially agreed with the scheme.

Mr. Molineux said with regard to the porcupine ant-eater at Kangaroo Island, it was most advisable that the nature and habits of the animal should be clearly known, and that there was so little information on the point was due perhaps to the fact that there were few scientific men on the island. The animal was so common there that its fat had been used for slush-lamps.

Mr. Smeaton said the information might be obtained from Mr. Wilson, who was an old resident of the island, and was a very observant man.

Dr. Gosse suggested that the Secretary might communicate with Mr. Wilson and get specimens of the ant-eater sent.

Mr. Molineux expressed himself strongly in favour of the Society attempting some such scheme as that proposed by Professor Tate in the cause of science and for the reputation of the colony. In our woods there were animals and insects of which it was most important that some knowledge should be obtained. There used to be a small marsupial on the Adelaide Plains years ago which had now disappeared, and Mr. Waterhouse, to whom he spoke, said he knew nothing of such an animal, but he (Mr. Molineux) remembered seeing it when he was a boy.

It was resolved that the Council should nominate a Committee to carry out the suggestions made by the President.

Ordinary Meeting, February 3, 1880.

Professor Ralph Tate, F.G.S., in the Chair.

Mr. W. Telfer, Wallaroo Hospital, was elected a Fellow.

The list of donations to the Library was read.

The Hon. Secretary read a draft of a letter to the Governor requesting him to forward a petition to Her Majesty the Queen praying her to become Patron, and to allow the Society to be known in future as "The Royal Society of South Australia." The letter and petition were unanimously approved. And it was also resolved to request His Excellency to become Vice-Patron in case Her Majesty assented to the prayer of the Society.

EXHIBITS AND NOTES.

The President reported that in connection with the proposed record of Natural History phenomena he had received several

letters and specimens. For the nature of the exhibits see Miscellaneous Contributions.

Mr. F. G. Waterhouse exhibited a number of fragments of skeletons of various extinct marsupial animals, including Diprotodon australis and Phascolomys gigas, in addition to several others, which had been presented to the South Australian Museum by Mr. R. M. Robertson, of Normanville, who found the first instalment in the bed of the Salt Creek, where they had been laid bare by the action of a freshet. At the first opportunity Mr. Waterhouse visited the place, but found the water too high to enable further search to be carried on; but Mr. Robertson kindly undertook the task of watching for further opportunities, with the result of raking up several other pieces, amongst them being several duplicates, proving that these were the remains not of several species of animals only, but of more than one of each kind. As Mr. Waterhouse was in doubt as to the true character of some of the remains, he forwarded duplicates to Professor Owen, at the British Museum, stating his opinion as to their nature, and received the following letter, confirming his ideas and thanking him for helping the Professor in his researches:—"British Museum, September 17, 1879. Dear Mr. Waterhouse—Accept my best thanks for your letter of June 18, 1879, and continued kind interest in my quest of the extinct mammals of Australia. Your case of fossils duly arrived. They included, as you state, parts of *Diprotodon* and of a gigantic wombat *Phascolomys gigas*. (This is generically distinct from the smaller *Phascolomys*.) The great kangaroo is of the interesting genus and species *Procontodon goliah*. The more fragmentary specimens I have not yet satisfactorily determined, at least as belonging to any species not hitherto known. . . . I am still hoping to get (in spirits) an impregnated uterus of either *platypus* or *echidna*, but at my age (75) I cannot but feel that the day of work is drawing to a close.—With every good wish, believe me most truly yours, Richd. Owen. Mr. F. G. Waterhouse, C.M.Z.S., Curator Adelaide Museum."

A brief discussion followed, the general surmise being that the bones which had been brought to light had not been deposited in the creek, which was not an old one, but had been unearthed by the washing away of the substance in which they lay.

The Hon. Secretary read some notes by Mr. Thomas Burgoyne, of Port Augusta, on "A Marsupial formerly found at Port Augusta," but now extinct there. The animal alluded to he thought was the smallest marsupial in the world. It had been met with on the eastern coast about Port Augusta 25 years ago, and, according to the accounts of the blacks, were

very numerous, and were known as kangaroo mice. The largest specimen did not exceed four or five ounces in weight. The domestic cat had been introduced at the period he had referred to, and the little animal had soon disappeared. He had obtained four or five specimens, but all of them dead; and one live specimen had died in a week from the time he had obtained it before he could observe its habits. It was almost a kangaroo in miniature, with a few differences. It did not move about in daylight, but was to be seen in the evening or at night, when it was seen to be a swift animal for its size. He thought, though it had ceased to exist in his district, it might be found further inland, and that communication with the officers on the telegraph line might result in specimens being procured which he thought would be of value.

Mr. Waterhouse said he knew the animal referred to from the description. It was not a marsupial, but a rodent; either *Hapolotus cervinus* or *Hapolotus Mitchelli*.

Paper read:—"On a Census of the Indigenous Flowering Plants of Extratropical South Australia," by Professor Ralph Tate (see p. 46).

Ordinary Meeting, March 2, 1880.

Mr. F. Chapple, B.A., B.Sc., Vice-President, in the Chair.

Messrs. W. C. Cox, H. C. Strother, Dr. J. F. Joyce, and the Rev. W. Hopkins were elected Fellows.

Mrs. Annie Richards, Fowler's Bay; Mr. J. Canham, Stuart's Creek; and Mr. Paul Foelsche, Port Darwin, were elected Corresponding Members.

The list of donations to the Library was read.

The Chairman said that in order to facilitate the operations of the Society it had been thought advisable to change the name of the Society by adopting the title of the "Royal Society of South Australia." The Secretary would lay the whole matter before them as it stood at present.

The Hon. Secretary said that he understood that the proper step to take was to forward a memorial to Her Majesty the Queen through His Excellency the Governor. It was advisable that this memorial should be formally adopted by the meeting, and not simply emanate from the Council, although the Council might be acting on the wishes of the members of the Society. He read the memorial which it was proposed to adopt. The prayer of the memorial was that Her Majesty would become Patron of the Society under the new title proposed, and the petition then proceeded to give a brief history of the formation and progression of the Society.

Mr. Todd, C.M.G., suggested that it would be advisable first of all to communicate with the Royal Societies of the neighbouring colonies, and to ask to be furnished with a copy of the memorial adopted by them when they took similar steps.

After a short discussion the matter was postponed.

The Hon. Secretary referred to the fact that forms had been circulated in various parts of the country, to be filled up by the recipients, the information which was sought to be elicited having reference to the sinking of wells and other borings in the colony. He had received a reply from Mr. W. Fowler, of Yaroo, Kulpara, furnishing the required records concerning three of these wells. Mr. Fowler gave their levels above the sea. The depths of the wells were 84, 145, and 165 feet respectively. The shafts all penetrated strata of the same character, and were situated about one mile or one and a half miles from the shores of the Gulf. Brackish water was struck at about the sea-level in each case, but the fluid was not too brackish for stock to use. Mr. Fowler promised to supply any further information that lay in his power, and to present the Society with a specimen of some fossils of mangrove roots found in the sinking of one of the shafts. These fossils were similar to those found some time ago at Port Wakefield. Mr. Fowler described the strata of sand penetrated, and expressed a belief that they rested upon a clay slate.

The following paper was read:—"Notes on the Comet of February, 1880." By Mr. C. Todd, C.M.G. (See p. 19).

An interesting discussion upon what is known of, and what has been speculated concerning comets, followed. Attention was particularly drawn by Mr. Ingleby, Q.C., and other speakers, to the remarkable circumstance that the recent comet did not actually set below the horizon, but faded into blankness as the night advanced, while its tail was still many degrees above the horizon, and questions were raised as to whether the luminosity of comets was self-existent, and internal, or whether it was merely a received and reflected light. Professor Tindall's theory of a body or vapour of great tenuity, made luminous by the operations of actinic rays of light from some light-giving centre, and afterwards being destroyed by the heat rays, was referred to, but Mr. Todd considered that this theory did not satisfactorily account for the curvature of the tail and many other peculiarities observable in comets. His opinion as to the nature of their nebulous light was that it consisted partly of internal and partly of received or absorbed light. Spectrum analysis proved that the nucleus of comets possessed self-luminous vapours, but no experiments with the spectrum had yet been carried out with the tail of any comet.

Mr. Ingleby said the comet did not set, but died away, which made him hold the opinion that the tail was borrowed light. He thought that the consideration of the circumstances of the rapid fading away of the comet might lead to useful discoveries respecting the constituent elements, &c., of these celestial phenomena.

In reply to a question, Mr. Todd stated that the various obstacles in the way of obtaining clear observations of the recent comet had prevented him from being able to calculate its distance from the sun, but, speaking roughly, and by no means committing himself to the statement, he should say the distance was under fifty millions of miles.

Reference was made to the frequent recent occurrence in our skies of large and brilliant meteors, and the theory that showers of meteors usually followed the appearance of a comet was briefly alluded to. A suggestion was made that in the statistical and general records now being compiled by the Society as much information as was possible should be obtained respecting meteoric appearances, and the Secretary promised to note the suggestion.

Ordinary Meeting, April 6, 1880.

Professor Ralph Tate, F.G.S., President, in the Chair.

Dr. John Rees, Hindmarsh, was elected a Fellow.

Mr. A. W. Dobbie was elected a member of Council in the room of Mr. R. Hickson, resigned.

The list of donations to the Library was read.

NOTES AND EXHIBITS.

Mr. F. G. Waterhouse, C.M.Z.S., on behalf of the South Australian Institute, exhibited land shells from South Sea Islands, presented by John Brazier, Esq., C.M.Z.S., Sydney. Fossils, minerals, and shells, presented by Mrs. William Jewell.

Mr. W. Fowler, of Yarroo, Kulpara, forwarded a specimen of fossil mangrove root, taken from a depth of 78 feet, or about sea-level, in the District of Kulpara.

Professor Tate said from what he knew of the country he could quite believe the plant remains indicated the fact that the land had been elevated above sea-level at a recent period.

Mr. D. Brown, of Port Adelaide, exhibited some rubbings of native wooden weapons showing incised ornament, which had been forwarded to him from the interior. His correspondent hazarded the opinion that the concentric rings indicated the practice of sun worship by the people who have carved them.

Professor Tate exhibited two specimens of similarly orna-

mented wood implements, received from Mr. Canham, of Stuart's Creek. He rejected the notion that the figures are symbols, and held the opinion that they were intended for ornament. The two specimens exhibited showed a symmetry of pattern of at least three styles, and he said that symmetry is the first aim of barbarous nations in their attempt at ornamentation, whilst symbolic characters are to a very large extent dissimilar. To further speculate on their meaning, he considered, must be labour thrown away, and he very much doubted if they can be regarded as the production of the untutored aboriginal.

Papers read:—1. "Some Remarks on the Late Comet," by Professor H. Lamb, M.A.

[ABSTRACT.]

Professor LAMB, in continuation of the discussion of the previous meeting on Mr. Charles Todd's paper, wished to consider two points only. The first was as to the results of the spectroscopic examination of comets, which he ventured to say was rather inadequately stated on the previous occasion, though that was no fault of Mr. Todd; and the second was as to a theory of comets propounded by Professor Tait, of Edinburgh. By the printed report of last meeting he saw that it had been stated that no very definite results had been arrived at by spectroscopic examination of comets. But since the instruments had obtained their present perfection no comets of very great brilliancy had appeared. When the great comet of 1858 was visible these appliances had not reached a state of perfection. But in 1874-5 had appeared Coggia's comet, and Dr. Huggins had examined it spectroscopically. From the coma he had obtained a spectrum of bright bands. From the nucleus he also got a gaseous spectrum, and the result of his observations appeared to suggest that in comets there is some solid matter, as in the tail, capable of reflecting sunlight, as shown by a continuous spectrum. The gaseous spectrum showed indications of heated gas in portions. The spectrum of bright lines which had been observed was similar to what had been observed in at least one other comet, and the same which was obtained from carbon, which was curious. On examining the spectrum a second time Dr. Huggins found bright lines, showing a shifting of the body, such as was observed in the case of the fixed stars. The theory of comets put forward by Professor Tait, of Edinburgh, was that comets consisted of a mass of stones, which might vary in size. It was strange that this was not put forward before by a Scientific Society or a scientific magazine, where it might have been expected to be found. It was in a lecture delivered to working men, and he had found it in *Good Words*. His idea was that the comet was

a swarm of meteors, and that these changed the appearance of the tail by changing their position towards each other in their orbit, and that when nearest the sun they would have the greatest velocity, and striking together with greatest force developed heat. They had in this the materials of both the continuous spectrum and the gaseous spectrum obtained. The theory was based on facts, and did not appeal to electricity to account for what could not be accounted for.

Mr. Chapple referred to the lightness attributable to comets, and though if they were composed of swarms of stones that they must have considerable weight. He also asked whether much of the light was not reflected sunlight.

Professor Lamb believed it was to some extent, but at the same time it could not be said that it was to any great degree, and there was a good deal of light which belonged to the comet itself. There must, therefore, be heat generated by these individual masses to render them incandescent. The Professor went on to speak of the late comet as having been seen at Buenos Ayres going northward, according to a telegram received at Kiel from Dr. Gould, of the Argentine National Observatory, and hoped in conclusion that when next we had a brilliant comet our Observatory would not be so badly supplied with instruments, or so inadequately provided with a staff, numerically considered. South Australia owed a great deal indirectly to scientific discovery, and while she could not be expected to keep up an establishment such as there was in Melbourne, the requisite instruments should be obtained.

2. "On the Native Plants of Yorke's Peninsula," collected by Mr. J. G. Otto Tepper, F.L.S., named and arrangements revised by Baron F. von Mueller, hon. memb.; and "Remarks on their Distribution," by Mr. J. G. Otto Tepper, F.L.S., corresp. memb. (See p. 25.)

Professor Tate said that it afforded him great pleasure to bear testimony to the excellence of Mr. Tepper's paper dealing with the distribution of the indigenous plants of Yorke's Peninsula in relation to the hydrographical and geological conditions. The Rev. J. E. Tenison Woods, in his "Geological Observations in South Australia," 1862, has pointed out the general dependency of floral features of certain parts of the South-East on geology; but in the present essay we have a first attempt to connect the distribution of particular plants with that of certain rock formations. The author recognises the influence of the rock formation as exerted through its physical properties—not through its chemical ones. Thus, a plant has predilection for granite not so much on account of the chemical constituents, which it may derive from the disintegration of the

rock, but rather from the circumstances of finding there such combination of physical conditions most favourable for its growth and propagation. Hence, a species restricted in the Ardrossan area to a granite may exist elsewhere on a rock of a very different type, provided always it presents the surface and sub-surface features of the granite. As instances of the kind he mentioned that *Casuarinæ* and *Pittosporum phillyræoides* cling to the quartzite bands in the Hundred of Munno Para, though they are generally distributed about Ardrossan; *Nicotiana suaveolens* lives on the Silurian limestones only about Ardrossan; but farther south about Stansbury, it occurs only on the seaward face of the Miocene cliffs. Local peculiarities most certainly occur, but they are not of sufficient magnitude to affect the aspects of the vegetation, which prevail over very large tracts of land in this country. Though they give rise, in some substances, to abnormal features; thus *Salsoli Kali*, which in Europe and throughout littoral Temperate Australia lives only within the influence of the sea, is a characteristic plant in the arid interior of this continent. Its presence there cannot be explained on the supposition that it has survived the geological changes which converted the interior from a submarine area to a continental one. Other plants, such as *Salicornia arbuscula* or samphire, are similarly out of place. The excessive variability of temperature and of the amount of aqueous precipitation, as rain and dew, must in conjunction with the hygrometrical properties of the soil determine to a large extent those lines of demarcation which separate extensive tracts of forest land from grass land regions, and in other cases. In tropical countries this phenomenon is still more marked, and the line of junction of absorbent and retentive soils can be traced on the surface by the changes in the botanical features. Perhaps in no other case is there such an intimate association between plants and soil, as is shown by the vegetation flourishing on the fluviatile Tertiaries, which occur here and there from Cape Jervis Promontory to beyond Nuriootpa. It did not escape the notice of Mr. Selwyn, who writes:—"On crossing the bridge over the Onkaparinga at Clarendon, and ascending the steep hill on the south bank of the river, a sudden change takes place in the character of the country, and the presence of Tertiary rocks is at once indicated by the deep sandy soil, and thickly covered with epacris, prickly acacia, dwarf banksia, coarse grass, and other scrubby vegetation, so characteristic of sandy Tertiary deposits." The vegetation is not so much peculiar as it is distinctive as a whole. Other sandy patches occur which do not present the same botanical facies, and it must be evident that other circumstances determine the assemblage of the plants on these par-

ticular tracts. The gregarious habit of many of our native plants is a very striking phenomenon, and in some parts of the interior acquires very considerable magnitude.

ORDINARY MEETING, MAY 4, 1880.

Professor RALPH TATE, President, in the Chair.

The list of donations to the Library was read.

The HON. SECRETARY read the petition to Her Majesty the Queen, praying that she would become patron of the Society, and that it might be styled "The Royal Society of South Australia." He also read the report of the Committee appointed to draft regulations *re* organization and direction of efforts of correspondents in natural history.

NOTES AND EXHIBITS.

Mr. MOLINEUX produced some specimens of a large moth *(Cossus cinereus)*, together with the larvæ, chrysalis, and silk-lined tunnels, and said it came out at two different periods of the year. In December one moth came out from the trunk of the tree in an upward direction, and left a large hole, into which the water found its way, rotting the tree and ultimately bringing it down. The other moth came from the ground in the roots in April and May. Coming out of the bole of the tree, they made no nest or silk, but, issuing from the root, the moth made a long chamber, of which he showed a sample. The larvæ and chrysalis existed in the tube for some considerable time. He was of opinion that the two must be different kinds of moths.

The PRESIDENT expressed the opinion that the moths were of two different species, and cited Mr. Tepper.

Mr. MOLINEUX said the nest made was of stiff clay. He had found nests, one with a caterpillar and others with a chrysalis inside. The chrysalis was often found near the top of the chamber.

There was a discussion, and Mr. SMEATON said he thought the moth was the same as that described as the *Zeuzera eucalypti*.

Mr. F. G. WATERHOUSE, C.M.Z.S., on behalf of the Governor of the South Australian Institute, exhibited a number of fossil bones recently obtained by Mr. R. M. Robertson at Salt Creek, Yankalilla, comprising portions of skeleton of the *Diprotodon australis*, including part of a lower jaw containing two incisors, portion of lower jaw with three molars, portions of two very large upper incisors, part of a rib, part of pelvis, two caudal vertebra, two portions of tibia, two portions of femur. He also exhibited a specimen of some remarkably rich auriferous

quartz from Woodside, taken from workings recently commenced there.

Master A. C. Molineux exhibited some freshwater shells; Mr. O. Tepper graphic granite and flowering branch of *Melaleuca uncinata*; Mr. Chandler flowering plants from Central Australia, and rock specimens and fossils from about the Peak; and Mrs. Richards flowering plants from the Great Australian Bight. (For particulars of the above see Miscellaneous Contributions.)

The following communication was read:—"Further Notes on Australian Salenariadæ." By the Rev. J. E. T. Woods, F.L.S., Hon. Memb. By consent of the Council this paper is incorporated with the author's first contribution, the publication of which was postponed last year. (See p. 1.)

Ordinary Meeting, June 1, 1880.

Professor Ralph Tate, F.G.S., President, in the Chair.

The list of donations to the Library was read.

NOTES AND EXHIBITS.

Professor Tate exhibited a skull of a wombat, obtained at the Willows during the construction of the deep drainage works, from the red loamy clays so characteristic of the Adelaide Plain. Skulls of the recent species of the Murray Plain and of the Great Australian Bight were shown for comparison, and though the fossil presents a greater resemblance to the latter, yet it is markedly distinct. In the absence of other materials for comparison, Professor Tate would not assign to it a specific name. In speaking on the subject, he remarked that our Public Library was very deficient in the literature of Australian zoology, and especially of this colony. Professor Owen's classic work on the Extinct Marsupials of Australia was an important desideratum.

Mr. F. G. Waterhouse, C.M.Z.S., showed a number of saurians, portion of a large collection of reptilia, lately received by the Governors of the South Australian Institute from the Paris Museum; also the snout of a large sawfish, the skin of a remarkably large brown snake, from Hindmarsh Island, measuring eight feet in length; and some rough Brazilian diamonds.

Professor Tate exhibited specimens of South Australian granites, showing inclusions. He said those from Port Elliot and Victor Harbour contain inclusions of a schistose character, which can only be regarded as fragments of extraneous rocks which have been caught up by the erupted granite and enclosed within its mass. The granite from Palmer and Mannum con-

tains inclusions of a different kind, which seem to be the result of an abnormal arrangement of the minerals constituting the granite itself. In respect to the specimen exhibited which was obtained from the massive granite boss situated on the east bank of the River Murray, about four miles north from Mannum, one may observe a dark circular area of three inches in diameter, which might, on a cursory inspection, be taken for a section of a more or less globose imbedded fragment of another rock, so strongly does the dark interior contrast with the exterior red of the granite. But on closer view the interior is found to be only much finer in the grain than the enclosing granite, whilst the darker colour is accounted for by the larger proportion of black mica. So far as his observations extend, granites having inclusions of the first kind are obviously *eruptive*, whilst those containing inclusions of the second kind are *metamorphic*.

The following communication was read:—

I. "On the Bay of Biscay Country," by Mr. J. G. Otto Tepper, F.L.S., Corr. Memb. (See p. 91).

A short discussion ensued, and Mr. Smeaton gave an illustration of Mr. Tepper's theory by diagram drawn on the blackboard.

Professor Tate mentioned that the Rev. J. E. T. Woods formerly held the opinion that the Bay of Biscay country might be attributed to gaseous exhalations.

Mr. Scoular supported that theory.

Mr. Smeaton remarked that at the time Mr. Woods promulgated the gaseous theory he was only acquainted with the South-Eastern country, and believed the Bay of Biscay country only occurred in country subject to inundation. He was not aware that similar curious formations were to be seen in the North.

Mr. Smeaton said he agreed with Mr. Tepper in part of his theory, but not in respect to his view of the original formation being connected with mud flats.

Ordinary Meeting, July 6, 1880.

Professor Ralph Tate, F.G.S., President, in the Chair.

The list of donations to the Library was read.

NOTES AND EXHIBITS.

Specimens of fresh-water shells from Central Australia, by Mr. Chandler.

A snake of about nine inches, marked by alternate bands of orange and black, said to have been taken at Wallaroo, by Prof. Tate.

A considerable number of specimens of exotic snakes, stuffed and in spirit; also, a sample of rich silver ore; by Mr. Waterhouse, on behalf of the South Australian Institute.

The following papers were read:—

"On some New Corals from the Australian Tertiaries," by the Rev. J. E. Tenison Woods, Hon. Memb. (See page 99).

"On some New Species of South Australian Pulmonifera," by Prof. Ralph Tate. (See p. 102.)

"On a New Belemnite from Central Australia," by Prof. R. Tate. (See p. 104.)

A Translation of Professor Quatrefage's "Craniologie des Races Australiennes," by Professor Tate. The paper in question dealt with the various opinions on the subject of the origin of the Australian race, whether or not the black population of Australia were indigenous or had in far-back times found their way over here from other regions. The craniological characteristics were dealt with, measurements showing the extraordinary length of the Australian native's skull being given. The conclusions arrived at were that there are two indigenous races in Australia; the one spread all over the continent, and presenting a marked homogeneity; the other, termed the Australoid—now confined to the South-East of Australia, and represented by few individuals—presents craniological characters typefied by the fossil Neanderthal skull.

Ordinary Meeting, August 3, 1880.

Professor Ralph Tate, F.G.S., President, in the Chair.

The list of donations to the Library was read.

NOTES AND EXHIBITS.

Mr. F. G. Waterhouse, C.M.G.S., Curator of the Adelaide Museum, on behalf of the Governors of the South Australian Institute, exhibited an interesting collection of exotic Batrachia, and some specimens of fresh-water tortoises received from the Paris Museum, also a few fossils from the Murray Cliffs near Morgan.

Professor Tate showed a number of mineralogical specimens sent to him by several correspondents, including a piece of translucent opal, distinguished by the name of Hyaline, found by Mr. Scoular in the slates at Munno Para; also some minerals sent by Mr. Salter, of Blinman, comprising Breunnerite, a carbonate of lime and magnesia, found at Nuccaleena; a flesh-coloured heavy spar, and a botryoidal form of magnesite, found at Blinman, and several other minerals sent by other gentlemen.

Mr. H. Lattorff forwarded particulars as to the strata gone

through in sinking a well on the western side of Lake Torrens, at a distance of about ten to eleven miles, and at an elevation of about 800 feet above the sea. The well was sunk to a depth of 128 feet when the borers came upon the bed rock, consisting of hard red slate (gneiss form), containing glimmer.

The following paper was read:—"On the Descriptive and Economic Geology of Munno Para East," by Mr. Gavin Scoular, Corr. Memb. (See p. 106.)

Professor TATE thought Mr. Scoular had proved himself a very careful geologist. He had reviewed the map, &c., and could state that Mr. Scoular had assisted greatly in the work of collecting information upon the geology of South Australia. The quartzites referred to had attracted his own notice when he first arrived, and he did not think such a marked feature as these bands presented on the banks of the Little Para River could be found elsewhere in South Australia. Mr. H. Strother had been over that part of the country, and thought it a remarkable piece of rock scenery—so remarkable that he contemplated taking a picture of some parts for exhibition at the Melbourne Exhibition.

Professor TATE defended his view of the lacustrine origin of the Upland Miocene, and contended that as the neighbouring outlier at Golden Grove was bounded on the west by higher land, so the contemporaneous deposits in Munno Para may have been accumulated in a lake whose western margin was the northerly continuation of that high land, since removed.

A long desultory conversation ensued, and the members separated at a rather late hour.

ORDINARY MEETING, SEPTEMBER 21, 1880.

Professor RALPH TATE, F.G.S., President, in the Chair.

Dr. W. Gaze and Mr. W. Smith were elected Fellows.

The list of donations to the Library was read.

Mr. E. P. Nesbit, jun., was appointed Auditor.

A copy of a despatch from the Secretary of State for the Colonies, notifying that Her Majesty had been pleased to assent to the prayer of the petition requesting her to become the patron of the Society, and to allow it to be known as "The Royal Society of South Australia," was forwarded by His Excellency Sir W. F. D. Jervois, and laid upon the table.

Notice of motion was given as to certain alterations in the Rules rendered necessary by the change of title and by the adoption of a scheme for the systematic record of Natural Science phenomena.

Dr. Wylde sent specimens of a minute moth, the smallest

known to him, which appeared to live on the leaves of *Salvia officinalis*.

The following communication was taken as read:—"On the Tertiary Palliobranchs of Australia," by Prof. Tate. (See p. 140.)

Mr. Charles Todd, C.M.G., here took the chair, and Prof. Tate gave a popular lecture "On Lamp Shells," in the course of which he said that the Australian seas have yielded fifteen species of palliobranchs, some of which extend to New Zealand, there associated with two restricted species. Our waters have furnished only four species, and with the exception of *Waldheimia flavescens* are of extreme rarity. They are:—

Waldheimia flavescens, which occurs around the south-east and south coasts of the continent. He had collected it at the two extremes of our coast-line.

Terebratulina cancellata has been found in dredgings on two separate occasions from Backstairs Passage by Mr. Bednall and Mr. S. Smeaton. Of the few individuals extant in the cabinets of our local conchologists, one only is adult. It is the largest living species in the genus.

Kraussia Lamarckiana is known as a South Australian shell from a few detached valves collected on the east shore of St. Vincent's Gulf.

Discina tenuis, described by Sowerby, is reported in Reeve's "Monograph of Crania" from China and South Australia. It is unknown to collectors here.

Annual Meeting, October 5, 1880.

Professor Ralph Tate, F.G.S., President, in the Chair.

The list of donations to the Library was read.

Dr. Nesbit was elected a Fellow.

The Hon. Secretary read the annual report and balance-sheet (see page xxxiv.), which were ordered to be printed.

Several alterations in the rules rendered necessary by the Queen's assent to the assumption by the Society of the title "Royal Society of South Australia," as also by the operations of the newly-organised division for the direction of efforts for the record of natural science phenomena, were agreed to after a short discussion.

Votes of thanks were accorded to the officers for the past year.

The following gentlemen were declared to have been duly elected as the officers and council for the ensuing year:—*President*—His Honor Chief Justice Way; *Vice-Presidents*—Messrs. C. Todd, C.M.G., and F. Chapple, B.A., B.Sc.;

Treasurer—Mr. T. D Smeaton; *Hon. Secretary*—Mr. Walter Rutt; *Councillors*—Mr. D. B. Adamson, Dr. Magarey, Prof. R. Tate, and Dr. J. D. Thomas.

The following papers were taken as read:—"Indigenous Plants of the Macdonnell Ranges," by Rev. J. Kempe; and "Diagnoses of New Species of Plants from South Australia," described by Baron F. von Mueller, translated and communicated by Mr. Stirling Smeaton, B.A.

The PRESIDENT then read his annual address (see p. xxxix.), which was ordered to be printed with the Transactions.

REPORT OF THE COUNCIL

OF THE

Royal Society of South Australia,

For the Year ending September 30th, 1880.

The Council have pleasure in reporting that the work of the Society has been carried on successfully during the past year, the following papers having been laid before it:—"Red Rust," by J. G. Otto Tepper, F.L.S.; "The Medicinal Uses of Wattle Bark," by S. J. Magarey, M.B.; "The Geographical Distribution of Plants in South Australia," by Professor Ralph Tate, F.G.S., &c.; "The Comet of February, 1880," by Charles Todd, C.M.G., F.R.A.S., &c.; "The Characteristics and Distribution of the Native Plants of Yorke's Peninsula," by J. G. Otto Tepper, F.L.S.; "Further Notes upon Australian Selenariadæ," by Rev. J. E. T. Woods, F.L.S., &c.; "Bay of Biscay Country," by J. G. Otto Tepper, F.L.S.; "Translation of Professor Quatrefage's 'Craniologie des Races Australiennes,'" by Professor Ralph Tate, F.G.S., &c.; "Some Fossil Corals," by Rev. J. E. T. Woods, F.L.S., &c.; "A New South Australian Belemnite," and "Some New South Australian Snails," by Professor Ralph Tate, F.G.S., &c.; "The Descriptive and Economic Geology of the Munno Para Hills," by Gavin Scoular; "A Monograph of the Tertiary Palliobranchs of Australia," by Professor Ralph Tate, F.G.S., &c.; "Native Plants of the MacDonnell Ranges," by Rev. J. Kempe; and "Diagnoses of New Species of Plants from South Australia," by Baron F. von Mueller, translated by S. Smeaton, B.A.

A large number of interesting specimens of natural history and other objects of interest have been exhibited and discussed at the Society's meetings. The Governors of the South Australian Institute have laid before the Society from time to time a selection from the donations to the Museum received by them, and private gentlemen have, to a greater extent than in any previous year, contributed in a similar way to the interest of the Society's meetings. In order to encourage and to assist private research, and to place the information thus acquired permanently upon record, the Society resolved early in the session to establish local correspondents throughout the province, and to obtain the services of competent referees in the various branches of natural history. This scheme has been fully matured by the Council, and the assent of the members

will be asked to certain alterations in the rules necessitated by the former resolutions of the Society upon this subject. The plan has already produced good results, and it is hoped that when in full operation it will lead to the accumulation of a large number of facts which would otherwise have remained unknown to the scientific world. The Government subsidy, which has been received for the first time this year, will assist in meeting the increased expenditure incurred by the enlargement of the sphere of action of the Society, whose usefulness will only be limited by the numbers of the subscribers to its funds.

The "Transactions and Proceedings" for 1878-9 were issued early in the session, and the greater portion of the volume for the session now closing is already printed. It is satisfactory to know that the value of the Society's work is increasingly appreciated by the learned Societies of other countries, as is shown by the increase in the number of such Societies which have responded to our invitation to exchange publications.

In accordance with a resolution of the Society, the Council has taken the necessary steps to obtain permission to assume the title of "The Royal Society of South Australia." Her Majesty has graciously acceded to our request, and the Society has thus been placed upon an equal footing with similar Societies in the other colonies.

While the work of the Society has been steadily developing the Council regret to report that the number of members has not increased, being now 102 as against 105 at the last annual meeting. Thirteen names have been added to the roll in all classes. One member, Mr. A. Murray, whose connection with the Society dated from the year 1858, has been removed by death; eight have resigned; and seven have been struck off the roll for non-payment of their subscriptions.

In a comparatively small community, such as that of Adelaide, there must of necessity be a very limited number of individuals sufficiently conversant with any one branch of science to take an intelligent interest in the details which make up the bulk of the papers submitted to the Society, and it is worth while to consider whether it would not be well to supplement the more technical papers with lectures of a more popular character. Such lectures would not be suitable for publication in our proceedings, but would greatly increase the interest taken in our monthly meetings, and might be the means of assisting many in their pursuit of science.

The balance-sheet shows that the finances of the Society are in a flourishing position, the balance in hand last year being £127, and this year about £187; but the cost of printing the Transactions will absorb a larger sum than before.

THE TREASURER IN ACCOUNT WITH THE ROYAL SOCIETY.

Dr.	£	s.	d.
To Balance brought forward	127	15	7
Subscriptions	81	7	0
Government Grant-in-aid	118	16	6
Sale of Transactions and Reprints	2	9	0
	£330	8	1

Cr.	£	s.	d.
By Contribution to Institute	12	0	0
Printing, &c., of Transactions	83	16	9
Advertising and Printing	22	16	10
Salary of Assistant Secretary	12	12	0
Commission collecting Subscriptions	1	15	9
Back to Cupboard	2	13	0
Postages and Sundries	7	8	0
Balance carried forward	187	5	9
	£330	8	1

Audited and found correct,

4th October, 1880.

E. PARISS NESBIT,
Auditor.

THOMAS D. SMEATON,
Treasurer.

DONATIONS TO THE LIBRARY

For the Year 1879–80.

Transactions, Journals, and Reports.

Presented by the respective Societies and Governments.

Edinburgh—Proceedings of the Royal Society, 1878-79.
Halle—Kais. Leopold.-Carol. Deutschen Akademie der Naturforschen. Part 24, 1878; Part 25, 1879.
Lausanne—Bulletin de la Société Vandoise des Sciences Naturelles. Vol. XVI., 1880.
London—Journal of the Royal Microscopical Society. Nos. 1 to 4, 1880.
Melbourne—Victorian Year-Book, 1878-9.
——— Patents and Patentees. Vol. X.
——— Statistics of Friendly Societies, 1878-9.
——— Report of the Board of Enquiry *re* Wattle Bark, 1879.
——— Statistical Register of Victoria. Parts 1, 2, 3, 4, 6, 8, 9, and Index (1878-9).
——— Report of the Department of Mines, 1877.
——— Astronomical Results, Melbourne Observatory, 1871-5.
——— Transactions and Proceedings of the Royal Society of Victoria. Vol. XVI., 1880.
——— Quarterly Journal of the Microscopical Society of Victoria; Nos. 1, 2, and 3.
New South Wales—Proceedings of the Linnean Society. Vol. V., Part 1.
——— Journal and Proceedings of the Royal Society. Vol. XII., 1878.
Queensland—The Westerly Winds of Brisbane. May to December, 1878. By the *Philosophical Society.*
St. Louis—Annual Report for 1879, and "Bulletin" of Public School Library. No. 4, 1871.
South Australia—Addresses at the laying of the Foundation-Stone of the South Australian Institute, 1878. By the *Board of Governors.*
Tasmania—Report of the Salmon Commissioners, 1879.
——— Catalogue of the Tasmanian Exhibits at the Melbourne Exhibition, 1880.

Vienna—Denkschriften der K. Akademie der Weissenschaften. Math. Natur. Classe. Nos. 10 to 19, 1880.

——— Verhandlungen der K. K. Zoologisch-Botanischen Gesellschaft. Vol. XXIX., 1879.

——— Verhandlungen der K. K. Geologischen Reichsanstadt, 1879.

Miscellaneous Books and Pamphlets.

(Names of donors in italics.)

Clark, Rev. W. B.—Remarks on the Sedimentary Formations of New South Wales.

Giles, E.—Geographic Travels in Central Australia. *Presented by Baron F. von Mueller.*

Haast, Dr. Julius von—Geology of the Provinces of Canterbury and Westland, N.Z.

Liversedge, Prof.—On the International Congress of Geologists at Paris, 1878.

Mueller, Baron F. von—Native Plants of Victoria.

——————— Fragmenta Phytographiæ Australiæ.

——————— Introduction to Botanic Teaching at the Public Schools in Victoria.

——————— Organic Constitution of Plants and Vegetable Substances and their Chemical Analysis.

——————— Eucalyptographia. Decades 4, 5, and 6.

Russell, H. C.—Rain and River Observations in New South Wales, 1880.

Schomburgk, Dr. R.—Naturalized Weeds in South Australia.

Taplin—Folklore, &c., of the South Australian Aborigines. Adelaide, 1879. *The South Australian Government.*

Todd, C.—Meteorological Observations at the Adelaide Observatory, 1878.

——— Rainfall of South Australia.

Wools, Rev. W.—Lectures on the Vegetable Kingdom.

——————— Plants Indigenous to the Neighbourhood of Sydney, 1880.

The Anniversary Address of the President,

Professor Ralph Tate, Assoc. Lin. Soc., F.G.S.

During the past year my leisure has been so severely and continuously taxed for the service of the Society that it has been impossible for me to prepare an address upon an appropriate subject for an occasion like the present. The theme which I had selected early in the year on "The Relationship of the Recent to the Tertiary Fauna of Australia," had to be abandoned, because the collocation of published facts and the determination of the specific and generic affinities of the fossils with recent forms of life, which would be the groundwork of the dissertation, proved to be a task that could not be accomplished within the time, except at the sacrifice of the performance of certain duties in my capacity as President of the Society and co-Editor of its publications.

In its stead I propose to take a retrospective glance at the condition of our Society for the past three years, during which time I have been honoured with the chief direction of its affairs, and also to furnish a record of the current literature dealing with the Natural History of Australia, more especially that relating to this colony.

The application made to the Government last year for pecuniary assistance has graciously been granted, and with the additional means at its command the Society is strenuously endeavouring to attain the main objects which it appears to me it ought to have in view.

One of its main objects ought ever to be to foster and perpetuate the taste for natural history throughout the province. And in this connection the Society, recognising the value and importance of a corps of volunteers from whose local knowledge they may expect to derive benefit, has elaborated a scheme for encouraging and directing the efforts of amateur naturalists. The scheme has been published only within the past month, and already a nucleus of workers has been formed. It has been highly approved by those to whom it has been submitted, and the leading specialists among Australian naturalists have freely consented to act as referees in their respective departments; their names have purposely been withheld,

because it is desirable that the Society be the channel of intercommunication, and filter as it were through the available local talent the possibly new facts from the certainly known. So far the machinery seems to be well devised and adjusted, and the experiment deserves success.

By this scheme the Society encourages the tyro-naturalists in their pursuits, an aid which is not afforded at present by the collection in our provincial Museum. But as soon as they shall have been well named and made easily accessible they should supply the professed student of biology with as complete materials for his researches as can be obtained. In the interest of the Institute Museum I offer the suggestion to the Board of Governors that the Trustees of the British Museum should be reminded not to forget this colony in its distribution of the duplicate specimens, which under a recent Act of Parliament they are empowered to part with. South Australia, in common with the sister colonies, has a claim upon the national Museum, to what extent it is difficult to determine; but that it owes to us some of its knowledge of the natural history of the colonies is obvious from the number of presentations made to it by South Australian collectors and correspondents.

As a further means in the same direction, the entry of all deserving students into our body has been facilitated. The pursuit of collecting and studying natural history objects give to the persons who are inclined to devote their leisure hours to it a beneficial training for whatever their real calling in life may be; they acquire a sense of order and method; they develop their gift of observation; they are stimulated to healthy exercise.

The meetings of the Society have been held with regularity, but in consequence of the great subdivision of science and the more technical character of the communications they have not been attended so well as in former years, when it was thought fashionable to do so. To revive such a former state would indeed be a retrograde action, as it would impair the efficiency of the Society. It must, moreover, not be expected that it lies within the province of the Society directly to impart elementary knowledge. Our meetings are held for the purpose of having new facts, or new views of the bearing of admitted facts, or corrections of important errors, brought before us for discussion, and not for mere elementary instruction, though some of us could probably testify as to how much may be incidentally learned through a constant attendance at the meetings. A middle course is, however, open by which we may hope to acquire popularity without in any particular impeding the attainment of the higher objects of the Society—that is, by the delivery of popular expositions of recent advances or of

new discoveries in science at alternate monthly or fortnightly meetings; these may be arranged so as to be introductory to technical papers to be submitted at a subsequent meeting. The meetings of the Society enable those who are interested in the same pursuit to meet together, and by friendly intercourse advance the cause of science. Discussion has often evoked information that has led up to investigations of the highest value, and should be encouraged, and not rudely suppressed by a display of cynicism not unfrequently indulged in by those whose lot it is to regard science more as a professional pursuit than of the nature of a relaxation for leisure hours.

Much of the surplus funds of the Society has been employed in publishing the Transactions of the Society, the third volume of which will be ready for delivery in a few weeks. The Council has ever been mindful of the necessity of maintaining a high character for its Transactions, and the reputation which it bears in the other colonies affords good evidence of its value. A judicious selection has been made from the papers submitted to the Society, and the illustrations have been provided with no niggardly hand. In regard to the former point it will be well for Fellows and other contributors to bear in mind that purely speculative questions, however well adapted to raise an interesting discussion, are, like those relating to merely elementary matters, not within the scope of the Society's Transactions.

The plan of an early issue of reprints of author's copies, which has been successfully carried out during the present year, has overcome much of the inconvenience attending the tardy publication of a yearly volume, as it will also enable us to publish the Transactions with greater dispatch than formerly. The number of contributors to the pages of our Transactions for the last three years is 14; eight for 1877-8, eight for 1878-9, and six for 1879-80. Of these five only are members, three are corresponding members, one honorary member, and five non-members. And though the number of workers is on the decrease, yet the results achieved seem to be of increasing merit; at any rate, each yearly volume has far outstripped its predecessor in point of size. The published papers show a wide range of subjects, but a very large majority is devoted to Natural History, as is indicated by the following summary:— Medical Statistics, 3; Physics, 2; Astronomy, 1; General Natural History, 4; Botany, 5; Zoology (recent and fossil), 13; Geology, 7; Mineralogy, 1; and Anthropology, 1.

The labours of the Society for the coming year are likely to present the same activity and the same wide range of subjects as ever. We have been made aware of the preparation of a catalogue of South Australian minerals, of a descriptive catalogue of our marine shells, a monograph of the Tertiary

echinodermata of South Australia, of a catalogue of the polyzoa inhabiting our waters, and of a paper on the geological structure of the Adelaide mountain chain.

I notice with pleasure that science forms part of the curriculum for teachers in training, and that encouragement in the study of botany has been given to pupils in our State schools. Cheap and good elementary text-books on botany are procurable, but before a more general study of our native plants can be initiated a manual is required somewhat after the model of Baron F. von Mueller's "Native Plants of Victoria." At present the only descriptive work is the "Flora Australiensis," of seven volumes, far too costly to be accessible to the many. A manual of South Australian botany, if restricted to the flowering plants and ferns of the settled districts, could be published at a price to bring it within the reach of all. We commend the suggestion to the Minister of Education.

Another great advantage our Society affords is the possession of a library of volumes, acquired by presentation or by means of exchange of our publications, which are of the greatest value to the student and are not extant in other libraries in this city. The number, it is true, is at present small, but the yearly additions are largely on the increase.

The increase in the number of members during the last three years has been much in excess of that for any former corresponding period, but losses have been disproportionately great.

Having thus pointed out what we have at our command to forward the interests of science in this colony, and what is being done in its behalf, and incidentally indicated some of the advantages that may be gained by joining our body, I will now address myself to those who are still doubtful as to the advantage of doing so.

The sphere of the Society's usefulness, other things being the same, is the more extended as its revenue is increased. Thus we want funds to stimulate and reward those engaged in investigating the natural history of this colony, and in other directions not strictly of a commercial character. It is the duty of all who wish to advance the study of nature to do what in them lies, and relieve such enthusiastic workers, that we have reason to know are amongst us, from the pecuniary burthen which their self-denying labour brings upon them.

The names of some Fellows of learned Societies, and many of the learned professions, are absent from our list of Fellows; why do they not further the progress of research, and make it possible for the Society to produce such works as would be of inestimable value, and redound to the credit of the whole community, whose intellectual status has been pronounced by

certain recent visitors, competent to judge, to be of a very low degree? It is obvious that a combination of members can produce a greater amount of valuable results than they would in the aggregate if working independently. And this Society, in its corporate capacity, performs services which no individual or individuals unassociated could render. It is a connecting link between the scientific workers of this and the neighbouring colonies.

The contention is, that because an individual cannot take an active part in the Society it is no commendable reason for his refusal to aid it. There are several gentlemen having natural history predilections who have and may profit by the results already achieved by the Society, yet are devoid of a patriotism for science; and there are others foremost among us as physicists, who if they were zealous in the cause of science would embrace the opportunity afforded by the meetings of the Society to communicate to an anxious and intelligent section of the community the results of investigation which they have been enabled to prosecute at the country's expense.

In some respects the members of this Society have themselves to blame, and I must acknowledge that I have been at times much disheartened at the apparent apathy for that which concerns the very existence of the Society. If the fault has been mine, then I shall be only too glad, for the Society's welfare, that it be proved from this evening forthwith to have been so.

In the President-elect you have a gentleman who brings a prestige to the Society, and whose well-known earnestness in the discharge of all public duties is a guarantee that in him you will have a warm advocate and a zealous partisan. He has told you that he is not a scientist, but in doing so he gives to the word a very restricted definition. We have had, perhaps, too much of what he regards as science—not too much absolutely, but rather too little of what is not natural science—and we anticipate that under the fostering care of our new President greater attention will be given to those departments of science which have been neglected by us for some years past.

In adopting the title of Royal Society of South Australia you have imposed on yourselves greater obligations. And as the change of title cannot materially affect the constitution of the Society, it behoves its members to greater exertions to justify their high pretensions. Let each member strive to deserve the honour of being its President.

It affords one pleasure to note the increasing activity of the several scientific bodies throughout the Australian Colonies, as is partly indicated in the summary of recent progress in natural history with which I shall conclude this address. New life has been infused into the almost defunct Microscopical

Society of Victoria by the untiring energy of its Secretary, Mr. Goldstein. It has already issued two quarterly parts of its Journal of seventy-eight pages and five lithographic plates. One valuable feature of the new Society is the holding of practice-meetings once a week. "These have become very enjoyable, partaking more of the character of Club meetings, where the members, unfettered by formalities, converse freely on subjects of interest, and where they may seek and obtain such help as they require." The naturalists of Melbourne have banded together under the title of a Field Naturalists' Club, for the purpose of outdoor work, and the meetings have been well attended. The zeal of its leaders cannot fail to stimulate an enthusiasm in others, and the Club will doubtlessly prove an efficient training-school for young naturalists. I have long since wished to have engrafted on our Society something of the character of a Field Club, but I have always been dubious as to whether such a character could be sustained.

RECORD OF CURRENT LITERATURE RELATING TO THE NATURAL HISTORY OF AUSTRALIA, PARTICULARY OF SOUTH AUSTRALIA.

Mr. R. Alston describes the anatomy of the little-known marsupial, *Antechinomys*, which, with *Phascologale*, *Antechinus*, and *Podabrus*, he regards as constituting a sub-family of the Dasyuriadæ. (Proc. Zool. Soc., London, June 15, 1880.)

Mr. E. Dobson, in the same issue, describes a new species of bat from Australia, which, on account of its large size, he calls *Megadorma gigas*.

The collections which have been made during the last few years in the southern part of New Guinea indicate resemblances previously unsuspected between the faunas of New Guinea and Australia. Many genera of mammals which were thought to be peculiar to the continent have been found on the great Papuan island. Among the more remarkable may be cited two species of Echidna (ant-eating porcupines); true, dwarf, and flying Phalangers; Cuscus; Macropus (kangaroos); Perameles or bandicoots; and *Phascologale*. But hitherto the true Dasyures or native cats had not been known to occur in New Guinea. This gap has now been filled up by the discoverd at the Arfak Mountains of a species of *Dasyurus*. This new species has been designated by Prof. A. Milne Edwards (Comptes Rendus, June 28, 1880, p. 1,518) *D. fuscus*, because of the very dark brown colour of its fur. It is the smallest species of the genus, and its size does not exceed that of a large common rat. It is interesting to note that the Australian species which it more nearly approaches, *D. hallucatus*, in

which the hind feet are also furnished with five toes, is only met with towards the northern extremity of Australia.

Professor Owen has determined that the ova of *Echidna hystrix*, in most respects, correspond closely with those of the *Ornithorhynchus*. The fission of the germ mass, like that in the rabbit's ovum, strengthens the conclusion that the Monotremes are viviparous. The functional quantity of both uteri in the genus Echidna corresponds with the equal development of the right with the left female organs, in which it differs anatomically from the *Ornithorhynchus*. (Proc. Royal Soc., London.)

Mr. W. Macleay's recent communications "On the Clupeidæ and Mugilidæ of Australia" (Pro. Lin. Soc., N.S.W., vol. iv., pp. 363-384 and 420 to 427) must further add to his high reputation as an ichthyologist. Since the death of Count de Castelnau he stands alone in this department of zoology.

Of the Herring tribe nineteen species, and of the Mullet tribe fifteen species are enumerated. Here, as in other instances, the name South Australia rarely appears. The author says—"The fishes of the west coast are very little known, and many discoveries are likely yet to be made on the northern; but probably we may accept the above lists as enumerating with some correctness the species of the southern and eastern coasts."

These papers, dealing with two groups affording many edible fish, are replete with information touching their habits, haunts, uses, &c. They raise so many questions of an economic character, that the greatest publicity should be accorded them. The development of our fisheries is of such importance from a national point that it should form a subject for the serious attention of our Government. Mr. Macleay points out the lines upon which an inquiry should be conducted which would accumulate the most useful information.

"Les Staphylinides de l'Australie et de la Polynesie." Par Albert Fauvel, Geneva, 1877-8, 2 vols., pp. 364.

The author has for many years given great attention to this family, and has published, in addition to other voluminous works on entomology, "Monographs of the Staphylinidæ of Central America, of Chili, Reunion, New Caledonia, N. Africa, N. America, and New Guinea." With such preparation, this last production of his pen cannot fail to have that value which results from the matured study of a particular group of living beings.

Mr. Masters' "Catalogue of the described Coleoptera of Australia" (1871-4) enumerates 78 species of Staphylinidæ, but M. Fauvel's census contains the names of 310 as belonging to this continent and Tasmania.

The Australian region comprehends for him three principal sub-regions—

1. The Austro-Malaysian, comprising the group of the Moluccas and that of New Guinea.
2. The Australian, properly so-called, comprising Australia and Tasmania.
3. The Polynesian, extending to the east as far as the Gambier Isles and the Marquesas, to the west to the Solomon Isles and to the Mariannes, to the exclusion of the Sandwich Isles. New Zealand should form an independent group.

The Polynesian fauna numbers 60 species, and that of Australia 310, whilst there are nine species only common to the two sub-regions.

The number of genera in Australia is 76, of which 10 are peculiar. The geographical distribution of the species is as follows:—S.W. Australia, 47; N. Australia, 17; Queensland, 112; S.E. Australia (New South Wales), 82; S. Australia (Victoria, Tasmania, and S. Australia), 122. Five species from Port Augusta are included in S.W. Australia; and the necessary correction will reduce the number of Western Australian species to 42, and raise that of Southern Australia to 127. The number of species determined from South Australian specimens is 24, belonging to 14 genera. Mr. Tepper, in his census published by the Society last year, gives 26 species of 5 or 6 genera.

One of the new genera instituted by M. Fauvel, uniquely represented by a South Australian species, is named *Correa*—a denomination already occupied for a well-established group of Rutaceous plants, a familiar example of which is *Correa speciosa*. As under these circumstances a dual employment of the cognomen will prove of inconvenience, I have been bold to suggest that of *Fauvelia* for the genus of beetles.

The plan of the work is excellent. Under each natural group is a synoptical table of the characters of the genera, and under each genus that of the species. Each genus and species is fully described; the diagnoses are in Latin, but the remainder of the text is in French. The work is not illustrated.

A list of the described Staphylinidæ of South Australia:—

Oxytelus subæneus, *Fauvel*, Port Augusta.
" semirufus, *Fvl.*, "
" impennis, *Fvl.*, Adelaide.
" sparsus, *Fvl.*, "
Xantholinus chloropterus, *Er.*, Adelaide, Port Augusta.
" socius, *Fvl.*, "

Homalota coriaria, *Kraatz*, Port Augusta.
" sordida, *Marsh*, Adelaide.
" politula, *Fvl.*, "
Calodera cribrella, *Fvl.*, " Port Augusta.
australis, *Fvl.*, "
Phlœocharis antipodum, *Fvl.*, "
Trogophlœus simplex, *Mots.*, "
Philonthus sordidus, *Grav.*, "
" hepaticus, *Er.*, "
" nigritulus, *Grav.*, "
Quedius thoracicus, *Fvl.*, "
Heterothops luctuosa, *Fvl.*, "
" picipennis, *Fvl.*, "
Conurus triangulum, *Fvl.*, "
Brachida suturalis, *Fvl.*, "
Fauvelia oxytelina, *Fvl.* sp., "
Bolitochara discicollis, *Fvl.*, "
Pæderus cruenticollis, *Germ.*, "

"Descriptions of New Species of Phytophagous Coleoptera." By Martin Jacoby. Proc. Zool. Soc., London, 1879, pp. 773 *et seq.* Among others, of one species from Tasmania and of two from Queensland.

Sir John Lubbock describes (in Journ. Linn. Soc., London, vol. xv., p. 186, 1880) a species of ant having a similar habit to the honey-ant of Mexico, "particular individuals of which are specially told off to serve as receptacles of food or animated honey-pots." This second species of the kind, to which the name of *Camponotus inflatus* is given, is reported to come from Adelaide; but that is, of course, inaccurate. It is probably the species which has, however, been received here from the tropical parts of Central Australia.

"On Seventeen New and Rare Spiders from New Zealand, with characters of four new genera." By Rev. O. P. Cambridge. Proc. Zool. Soc., 1879, pp. 681 *et seq.* Plates 52 and 53. Though not any of the species here described are known to occur in Australia, yet the paper is valuable to us as affording new particulars touching the systematic position of certain of our species and of their alliances.

The Australian Crustacea are being dealt with in a most vigorous manner by Mr. W. A. Haswell, whose previous contributions to Carcinology had indicated the considerable neglect that this class of animals had suffered at the hands of naturalists.

The last two numbers of Vol. IV. of the Proc. Lin. Soc., N. S. Wales, contain the following papers from his pen:—

"The Australian Amphipoda," pp. 245-279, 319-349, plates 7-12 and 18-24 (1879).

The number of described species hitherto known was thirteen only, whilst the above papers contain 75 new species, comprising nine new generic forms. The specimens at Mr. Haswell's command have all been obtained (with two exceptions) from Tasmania and New South Wales, and not one is common to the two areas. The habitat of a species named *Talitrus sylvaticus* is peculiar, being abundant in moist ground in woods and scrubs of New South Wales, extending inland at least as far as about 30 miles from the coast. It has never been observed on the sea shore.

"On some new Amphipods from Australia and Tasmania," *loc. cit.*, Vol. V., pp. 97-105, plates 5-7 (1880). Is a supplemental paper describing eleven new species, one of which is the type of a new genus.

"On the Australian Brachyura Oxyrhyncha" (*loc. cit.*, pp. 431-468, plates 25-27, 1880).

Mr. Haswell's researches among the Australian spider crabs have added 37 species to the nineteen previously recorded; whilst the genera represented has been increased from thirteen to 27 (one new). The greater number of the species was obtained on the eastern coast and in Torres Straits. The new species, seventeen in number, are described, and most of them figured. Whilst full references to the species of earlier authors and authenticated localities are given. South Australia is uniquely represented by *Micippe parvirostris*, originally described by Miers from a Port Lincoln specimen. And in this connection I will quote from the author:—"So little is known of the marine zoology of the south of Tasmania and the west coast of Australia that it is impossible to treat with any degree of minuteness of the geographical distribution of genera within the Australian province. Two well-defined faunas are, however, readily separated and contrasted, viz., the temperate and the tropical."

"On Two New Species of Paratymolus (Brachyura) from Australia" (Ann. and Mag. Nat. Hist., vol. v., pp. 302-4).

A revised list of all the Echini known to the Rev. J. E. Tenison Woods as occurring on the Australian coast will be found in vol. iv. Proc. Linn. Soc. N.S.W., pp. 288-290. This is an amended list to that given by him in vol. ii. of the Proceedings of the same Society. Two new species collected between Moreton Bay and Port Jackson are also described and figured. One, *Hemiaster apicatus*, is interesting as representing a genus previously unknown in a recent state in the Australian seas, and one which is most abundantly represented in cretaceous

strata; a species is fossilised in the Murray Cliffs. The other, *Phyllacanthus parvaspina*, suggests a generic relationship with *Cidaris Australiæ*, one of our common Miocene fossils.

"Descriptions of New Species of Axinæa and Pectunculus," by G. F. Angas (Proc. Zool. Soc. London, 1 pl., May, 1879).

Includes *A. modesta*, from Australia; *A. Nova-Caledoniensis*, from New Caledonia; *P. Nova-Guinensis*, from New Guinea; and *P. orbicularis*, from Bass Straits. The last is identical with *P. flabellatus* (Tenison Woods, 1877), and is probably a small form of *P. laticostatus*, Q. and G. *P. flabellatus* is living in St. Vincent's Gulf, and is not uncommon in the higher beds of the Miocene formation in various parts of the colony.

The same author in the vol. for 1880 describes and figures (pl. xl.) the following new species of Mollusca from South Australia:—*Helix Bordaensis*, from Cape Borda, Kangaroo Island, which belongs to the same curious group of the section Rhagada as *H. Silveri*, Ang., and *H. Kooringensis*, Ang., from the Northern Areas of this colony. *Glyphostoma paucimaculata*, *Clathurella crastella*, *Rissoina lyrata*, *R. elegantula*, *Amauropsis globulus*, *Adeorbis Vincentiana*, and *Collonia roseo-punctata*, from St. Vincent's Gulf; communicated to the describer by myself and Mr. Bednall.

On the same plate are figured for the first time the magnificent shells *Murex Bednalli*, Brazier, and *Voluta Bednalli*, Brazier, and also *Clanculus bicarinata*, collected by Mr. Bednall at Port Darwin.

"The Cæcidæ of the Challenger Expedition," by Marquis de Folin (Proc. Zool. Soc., London, 1879).

Seven species of this family of gasteropods were dredged by the Challenger off Cape York. They belong to *Parastrophia*, 1 sp.; *Watsonia*, new genus, 1 sp.; and *Cæcum*, 5 sp. With the exception of *C. Chinense*, they are new to science.

"Mollusca of the Challenger Expedition," by the Rev. R. Boog Watson (Journ. Lin. Soc., London, vol. xiv., pp. 692 *et seq.*, 1879; and vol. xv., pp. 87-126, 1880). The only Australian species are *Gibbula glyptus*, n. sp., taken in 410 fathoms; *Solariella Phillippensis*, n. sp., in 38 fms.; *S. albugo*, n. sp., in 2-10 fms., off Port Jackson; *Fossarus cereus*, n. sp., in 1,400 fms., East of Cape York; *Bittium pupiforme*, n. sp., Wednesday Island, Cape York; and *B. cylindricum*, n. sp., 2-10 fms., Port Jackson.

"On the Occurrence of Recent Heteropora." By A. W. Waters. Jour. Roy. Microscopical Soc., London, vol. ii., p. 390, pl. xv. 1879.

In this communication the author has described a species of

Heteropora from the Semaphore, South Australia, under the appellation of *H. cervicornis*, considering it to be identical with the *Plethopora cervicornis*, D'Orbigny, from the cretaceous rocks of France; he also mentions a second species from the seas of Japan. Till the appearance of this interesting communication no recent species belonging to the genus seems to have been published. A third species has been described by Mr. Busk (Journ. Linnean Soc., London, vol. xiv., p. 724, 1879; pl. xv.), which he had received from New Zealand. The occurrence, therefore, of the above three species belonging to a genus of which we had previously no species more recent than the English Crag, and extending back to the Jurassic period, is of particular interest.

Heteropora cervicornis is associated on our coast with a very common Cellepora which has a similar mode of growth; so much that a microscopical investigation is necessary for their separation. Mr. Waters cannot identify the Cellepora with any described species, and distinguished it as *C. repleta*, a figure of which is given; but it is the *C. tubigera*, Hutton (Proc. Roy. Soc., Tasmania, p. 24; 1878.)

Rev. T. Hincks' "Contributions towards a General History of the Marine Polyzoa" (Annals and Mag. Nat. Hist.; July, 1880), give figures and diagnoses of seven species of Membranipora from the Australian Sea; five are new to science, and one—*M. delicatula*, Busk (*Biflustra* sp.)—is common to Australia and Florida, and is fossil in the English Crag. No localities are given for the Australian species.

"The Journal of the Microscopical Soc. of Victoria," vol. i., Nos. 1-3, contains several papers on Polyzoa.

Mr. J. R. Y. Goldstein furnishes diagnoses of two new species—*Serialaria Woodsii* and *Catenicella ponderosa*—obtained at Portland. The same author's notes on living polyzoa supply much new information respecting the polypes of several species.

Mr. Chas. M. Maplestone describes as new *Bicellaria annulata* and *Catenicella pulchella*. The great peculiarity of the first species is the spindle-shaped structure upon which the cells grow; and from the ringed appearance of the individuals the specific designation is derived. In fact, the author thinks that a new genus is requisite for its reception.

Mr. J. Brambridge Wilson has instituted the genus *Catenicellopsis*, separated from *Catenicella* by the mode of branching. It comprises two species, here described as new under the names *C. pusilla* and *C. delicatula*. The same author announces the occurrence of fossil Catenicellæ in the Miocene Rocks at Bird Rock, near Geelong. At least twenty distinct species have already been observed. Their illustration and complete

description are reserved for a future time, though in the present issue the differential characters of twelve species are given, unaccompanied by specific terms.

Rev. J. E. Tenison Woods describes a new genus and species of Polyzoan, under the name of *Tetraplaria australis*, obtained from Miocene strata at Muddy Creek, near Hamilton, Victoria. *Tetraplaria* is allied to *Gemellaria*, but the pairs of cells face alternate in two ways—that is, the faces are on all four sides of the cylindrical branches, and they alternate in each of the opposing cells arising on the side of the centre of its alternate neighbour. (Proc. Roy. Soc., New South Wales, vol. xii.; 1879.)

Rev. J. E. Tenison Woods describes and figures a fossil coral of great beauty from the Muddy Creek Miocene beds. It belongs to the genus *Montlivaltia*, and adds another link to that chain of facts which gives the Tertiary fauna of Australia such a Mesozoic aspect. The species is named *M. discus*. He also establishes a new genus with the name of *Trematotrochus*, and includes under it his *Conocyathus fenestratus*, from the Muddy Creek beds, and *Trochocyathus heterocostatus* from the Aldinga beds. The typical species of this genus combines some of the leading characteristics of several sub-families; it has neither pali nor columella, and the wall is perforated. In exterior form it is very like Antillia. Proc. Royal Soc., New South Wales, vol. xii., 1879.

"On the Cyclostomatous Polyzoa of Port Jackson." By W. A. Haswell. (Proc. Lin. Soc., N.S.W., vol. iv., p. 350, 1879.)

This is a descriptive catalogue of the species of the sub-order occurring in and around Port Jackson. The total of fourteen is made up as follows:—*Idmonea*, 3 sp. (one new); *Pustulipora*, 3 sp.; *Tubulipora*, 1 sp.; *Discoporella*, 5 sp. (three new); *Crisia*, 2 new sp.

"On some Polyzoa from the Queensland Coast." By W. A. Haswell; *loc. cit.*, vol. v., p. 33.

This is a list of 59 species obtained by the author at Port Denison, nearly all of which were obtained with the dredge in a single spot close to Holborn Island, 20 miles to the north-east of Port Denison. "Here the bottom, at a depth of about 20 fathoms, seemed covered with little else than *Polyzoa*. . . These are no doubt in the act of forming by their gradual growth and decay more or less extensive deposits analagous to the Polyzoa beds characteristic of the Tertiary formations of South Australia and Europe." The following are described and figured as new species:—*Crisia*, 1 sp.; *Pustulipora*, 1 sp.; *Onchopora*, 3 sp.; *Scrupocellaria*, 2 sp.; *Membranipora*. 1 sp.;

Biflustra, 2 sp.; *Lepralia*, 6 sp.; *Cellepora*, 2 sp.; *Eschara*, 2 sp.; *Hemeschara*, 1 sp.; *Vincularia*, 1 sp.; *Conescharellina*, 2 sp.; *Sclenaria*, 1 sp.; *Sphæropora*, 1 sp.; and *Myriozöum*, 1 sp.

An interesting addition to Australian fossil botany is the extinct conifer *Araucaria Johnstoni*, recently made known to science by the technical description by Baron F. von Mueller, K.C.M.G., appended to the reports of the Victorian Mining Surveyors for the quarter ending September 30, 1879. The species is founded on impressions of branchlets and the summit of a fruit cone, which were discovered very recently imbedded in the yellow Tertiary freshwater limestone near Hobart Town, Tasmania, by the assiduous and circumspect naturalist Mr. R. M. Johnston, F.L.S., of Launceston. The locality where this fossil Araucaria was found is to us of classical interest. It was visited by Charles Darwin, then naturalist to H.M. ship Beagle, during the stay of his ship at Hobart Town, and is alluded to by that illustrious scientist in his "Journal of a Naturalist," p. 448, and also in his work on volcanic islands. It was later examined by Count de Strzelecki, and several of its fossils, leaves, and land shells are figured in that traveller's work, "Physical Description of New South Wales and Van Diemen's Land, 1845." Mr. Johnston considers these organic relics, notwithstanding the close affinity of some of them to forms of the present vegetation, as belonging to the Miocene period, a view also taken by Professor McCoy, and to some extent supported by the father of Australian geology, the late Rev. W. B. Clarke. The phytiferous limestones of Hobart Town are in places covered with a mass of felspathic basalt, and must therefore be of earlier date than the volcanic effusion which Professor Ulrich considers as co-eval with that of Victoria, designated as the older volcanic formation. In various parts of Victoria this basaltic cover conceals the so-called older gold drifts, which contain a now extinct sylvan vegetation made known to us by Baron F. von Mueller's numerous "Observations on New Vegetable Fossils of the Auriferous Drifts." Mr. Johnston has found in association with the new conifer congeneric and even conspecific types of plants from the Victorian gold drifts, thus leaving little room for doubt as to the contemporaneity of the two widely separated plant-bearing deposits. One point of interest attached to the discovery of *Araucaria Johnstoni* is that of the geological distribution of the genus. The earliest traces of distinctly coniferous wood known, those from the carboniferous system, belong to the Araucarian type; but the actual genus *Araucaria* does not go farther back than the Trias. It flourished in Jurassic times in Europe and India, but is not definitely known at present in Cretaceous rocks, and it has generally been held that Araucarias

became extinct north of the equator since the Oolitic age. In a living state they are confined to extra-tropical and sub-tropical South America, Australia, New Zealand, and some of the South Pacific Islands. Of these two familiar forms are known as the "Norfolk Island Pine" and the "Moreton Bay Pine." The Oolite of Europe in the relics of marsupial animals, in the remains of fish analogous to the Port Jackson shark (*Cestracion*), and in the still more remarkable occurrence of the molluscan genus *Trigonia* and of the coniferous Araucarias still existing in Australia, afford a striking correspondence with the present fauna and flora of this portion of the globe. From these circumstances it has generally been held that Australia, in which alone this type of the oolite zoology and botany has been preserved, was at that epoch connected with India and Europe by dry land.

The researches of Mr. J. Starkie Gardiner amongst the plant-bearing strata of Bournemouth, England, have, however, established the fact that a species of Araucaria, indistinguishable by any discoverable character from *A. Cunninghami*, which forms vast forests on the shores of Moreton Bay, flourished abundantly in England during the Middle Eocene Period. Here its associates were, amongst others, *Dammara*, *Eucalyptus*, and many Proteaceæ, which are strictly forms of the southern hemisphere. The presence during the Eocene Period in what is now cold temperature Europe of a flora now distinctive of the warm temperate and sub-tropical regions of the southern hemisphere, proves that some of the at present purely Australian genera neither originated nor became differentiated in Australia, and whose very specific differentiation was accomplished in part before the Miocenes began. The discovery of Araucarias in a fossilised state in England and Tasmania, and belonging to an early period of their Tertiary age, is one of great interest, as establishing an important link in the series of changes which separate Oolitic times from the recent epoch.

"Fragmenta Phytographiæ," vol. xi. By Baron F. von Mueller.

Fasiculus xci., Feb., 1880, contains diagnoses of the composites *Leptorrhynchus elongatus*, De Candolle, and *L. medius*, A. Cunningham. The latter is reduced to the rank of a variety of the former by Bentham in the Flora Australiensis. The leading differential characters are for:—

L. elongatus, corolla white or ochreous-white; achenes elongated, glandular-scabrous, attenuated towards the apex.

L. medius, corolla yellow, achenes short turgid, nearly smooth, with a much elongated slender beak.

Fasiculus xcii., August, 1880, contains descriptions of the following new species discovered in South Australia:—

An Acanthaceous plant, *Justicia Kempeana*, p. 101, from near MacDonnell Ranges. (Rev. H. Kempe).

A cyperid, *Schœnus Tepperi*, p. 106, near Ardrossan. (O. Tepper).

A fungus, *Battaria Muelleri*, Kalchr. *M.S.*, p. 106, near Ardrossan. (O. Tepper).

ON SOME RECENT AND FOSSIL SPECIES

OF

AUSTRALIAN SELENARIADÆ (POLYZOA).

By the Rev. J. E. Tenison Woods, F.G.S., F.L.S.,

President of the Linnean Soc. of N.S.W., Hon. Member of the Adelaide Phil. Soc., &c., &c.

(Read September 2, 1879.)

[Plates I—II.]

The Selenariadæ is a family of Polyzoa, proposed by Mr. G. Busk in 1853 in the British Museum Catalogue of that class (part 2, p. 97). It is comprised in the order Gymnolæmata, suborder Cheilostomata, section Inarticulatæ, sub-section Rigidæ, group Liberæ, or with the zoarium unattached, usually discoid, conical, or irregular. The family includes orbicular, or irregular conical or depressed zoaria, which are convex on the upper side, and plane or concave on the other. They are composed of a single layer of cells, usually of two kinds, which open on the convex surface only. They were included among Foraminifera by Lamarck and Lamouroux; but the latter classed them amongst his Milleporidæ, and suggested the subgenera *Cupularia* and *Lunulites* (Exposit. Method., p. 44), which Busk subsequently adopted as genera. The true nature of the organisms was perceived first by De Blainville, who placed them at the head of his family Cellariæa, and close to *Flustra*. He characterises his genus *Lunulites* as consisting of cellules, with a superior opening disposed in concentric circles and radiating lines, so as to form a calcareous polypidom, somewhat regular orbicular, convex above, concave below, and marked with furrows radiating from the centre to the circumference. He cites as species *L. radiata*, Lamarck (Anim. s. vert., vol. 2, p. 191), copied into the Encyclop. Meth., pl. 479, fig. 6 a. b. (Atlas, pl. 75, fig. 5 a. b.), *L. urceolata*, Lam., l. c and Lamouroux (Gen. Polyp., pl. 73, fig. 9 to 12). He then adds that this genus has been established by Lamarck for the above two small fossils, only differing from true Flustras in being free and having a determinate circumscribed form. He remarks, further, that the second species had appeared in

Lamouroux's esti mation to possess features entitling it to generic distinction, for which he proposed the name of *Cupularia;* and he says that in effect the disposition of the cells is somewhat different, and the polypidom is not radiate.

Lunulites are described by Munster (Goldfuss, Petrefac, Germ., 1826, vol. i., p. 105; plate 37, fig. 7, *L. rhomboidalis*), by Michelin (Iconograp. Zool., 1841, p. 279, plate 63, fig. 12, *L. Vaudenbeckii*), and by A. E. Reuss (Naturwissen schaftliche, Abhandlungen, Vienna, vol. ii., p. 58, plate 7, fig. 26 and 27). The genus is also mentioned by Hagenow (Bryoz., Maestr. Kreid., plate 12, fig. 15 and 16), D'Archiac (Mem. Soc., Geol. de France, vol. ii., p. 196, plate 5, and vol. iii., p. 412), Leymerie (op. cit., vol. i., p. 358, plate 13), P. H. Nyst (Descrip. des Coquilles et Polypiers Fossiles de Belgique, p. 624, plate 48, fig. 6-8), Defrance (Diction. des Sciences Naturelles, vol. 27, p. 360, Atlas plate 50, fig. 5), Deslongchamps (Encycl. Zooph., p. 501), Mor ren (Decrip. Coral Foss. in Belg. report, 1828, p. 44), Lea (Contrib. to Geol., plate 6, fig. 202), Galeotti (1837, Mem. Geog. du Brabant, p. 163), Scacchi (1834, Notizie inta alle Couch ed a Zoofite Foss., p. 16, plate 2, fig. 7, 8), Lonsdale (Jour. Geol. Soc., vol. i., p. 503), S. Wood (Ann. Nat. Hist., vol. xiii., p. 18), Conrad (Silliman's Jour., Oct., 1841, vol. xli.), Gray (Spicilegium Zool., part 1, plate 8, b. 3, fig. 15), Busk (Quart. Jour. Micros. Soc., vol. vii., p. 6);* also British Museum Catalogue of Polyzoa; Palæontographical Soc., 1857, Foss. Polyz. of the Crag, p. 78.

It is in the latter publication that Mr. Busk gives a lengthened notice of the whole family of Selenariadæ, and reviews the relations of the existing species to those known as fossil. He figures and describes two species of *Cupularia*, which are found as fossils in the Crag (Pliocene) of Suffolk, England; but one only found alive at Madiera,† the Canary Isles, and the coast of Africa. Also, two species of *Lunulites* which have no living representatives.

In spite of the divisions proposed by Mr. Busk, which are clear and convenient if not quite natural, there is some confusion still as to the limits of the family and the names of some of the genera. *Cupularia* is used by D'Orbigny as a genus of the family of FLUSTRINOIDEA, tribe FLUSTRELLARIA, which includes ESCHARIDÆ, which are entirely without pores, avicularian or vibracular pores, I suppose. This tribe includes *Trochopora*, *Discoflustrellaria*, *Cupularia*, and *Lateroflustrellaria*, all of which have the zooœcia growing on a convex discoidal free zoarium. In *Trochopora* there are radiating lines like costæ

* I have not included Cuvier, Brongniart, or Brown, as their species are doubtful.

† See Jour. Micros. Soc., Oct., 1878.

on the under surface corresponding with the lines of cells. These lines are porous. In *Discoflustrellaria* there are no pores. In *Cupularia* there are neither pores nor lines. They are secondary fossils described by D'Orbigny in his Palcontologie Francaise, vol. 5, p. 506, 513, pl. 601 and 722; Defrance, Dict. Sciences Nat.; Michelin, Icon. Zooph., pl. 77, figs. 9 and 10. It is necessary to bear these distinctions in mind, as it will be seen they apply to some of our Australian fossil species. It seems that while Busk has employed the genus of Lamouroux in one way, D'Orbigny has done so in another, the latter having priority.

There is also some difference of definition for the genus *Lunulites*, for while Busk states that it is never attached at any stage of its growth the *Lunulites* of D'Orbigny, D'Archiac, Leymerie, and Michelin are attached during their young stage; and Hagenow (Die Bryoz., d. Maestricht. Kreidebild., p. 100, pl. 12, fig. 15, 16) states that he has seen *Lunulites semilunaris* and *L. Goldfussi* attached by the entire surface upon Belemnites. Busk thinks the attachment must have been accidental, but my own opinion is that too much importance is given to the character, as free polyzoa are sometimes found encrusting corals, &c.

Mr. Busk points out that in all the members of this family there are, in addition to the ordinary cells, others which differ in size, and whose office was variously interpreted until the discovery by Mr. McGillivray of living examples enabled Busk to determine that they were vibracular cells. The purpose served by the *vibraculum* is not well understood. The organ consists of a cup containing a muscular apparatus, and of a moveable seta articulated to the cup. The *seta* is in most cases simple and fine-pointed, but in some of the Selenariadæ it is bifid or trifid at the extremity. In *Selenaria maculata* it is spirally contorted and minutely annulated, so very closely as to resemble the proboscis of a butterfly. It may serve the purposes of defence and even locomotion, but observations on the subject are needed.

Whatever purpose they may serve, they have been made in the hands of the naturalist useful organs for classification, as will appear from the following division proposed by Mr. Busk in the British Museum Catalogue:—

FAMILY SELENARIADÆ.*

Zoarium free orbicular or irregular conical or depressed, convex above flat or concave below, upper surface only celluliferous. Zooœcia of two kinds disposed in series or quincuncially.

*The orthography in the Crag Polyzoa is *Selenariidæ*.

The genera of the family are five in number, which are thus distinguished—

Cupularia, Lamouroux.—Each cell with a vibracular chamber at its apex or distal extremity.

Lunulites.—The cells and vibracular chambers disposed in separate, usually alternate, rows radiating from the centre.

Selenaria, Busk.—Some of the cells only of a different form from the rest and furnished with a vibraculum.

Stichopora, Hagenow.—No apparent vibracular cells.

Conescharellina, D'Orbigny.—No vibracula; mouth of cell circular. Avicularia present.

Hitherto only from Australia species have been described—one *Cupularia* and three *Lunulites*. The latter, according to Busk, are representatives of fossils found in the Cretaceous period—another interesting link between Australia and Mesozoic forms. There are five species recorded from the Pliocene formation, eight from the Miocene, seven from the Eocene, and eighteen from the Cretaceous. Of the latter species only one is a *Cupularia* and two *Stichopora*, and the rest, fifteen in number, are *Lunulites*.

Cupularia is now our largest genus, but the existing species of *Lunulites* are very much larger in size than the fossil forms, if we except the giant species, *L. magna*.

I have now to introduce to science twelve new species and a variety in this interesting and very beautiful family of organisms, namely, two species of *Cupularia*, five of *Lunulites* and five of *Selenaria*. Of these four are living and eight fossil. The recent forms are all from the east coast of Australia. The fossils are chiefly from the Muddy Creek Miocene beds of Western Victoria, but the following South Australian localities have contributed to the list:—Mount Gambier, polyzoal limestone; Upper Murravian beds at Morgan, and the inferior beds at Blanche Point, Aldinga Bay. Australia has been already celebrated for being the only surviving home of the almost extinct genus of Lunulites; and it is interesting to observe that there is a new living form of that peculiar solid type, which has been figured and described by Busk. Our four fossil forms are different from those already known.

Both the living and extinct Cupularias are new forms of much interest, but the relations of the fossil species are remote to any living or extinct form.

There has hitherto been only one known species of *Selenaria*, occurring on the south coast of Australia. To this I am enabled to add two others, very distinct from their congener, and three fossil forms, all of extreme interest and beauty, and of a distinct type. One of them has a peculiarity in common with one of the new living species here described, that is in

the margined ribs of the under surface, but in all other respects they differ completely. As far as we know, none of the fossil species have living representatives, but comparatively so little is known of the living polyzoal fauna of our coasts that it would be quite premature to assert that any of them are extinct. It is, however, a remarkable fact that so far as we know there are very few living representatives of the rich polyzoal fauna of our tertiary beds. But I think it may safely be affirmed that any one seeing the present collection of fossil Selenariadæ would not hesitate to pronounce them Australian in character, and we may therefore *assume* that in Miocene times the polyzoa had already acquired an Australian facies. I have observed elsewhere that we could never expect to find in a fossil state such genera as *Catenicella*, *Menipea*, &c., as their horny joints could not resist decay, or would not fossilise. If, therefore, the Australian Miocene fauna was more like the present, much of the evidence of this must necessarily have perished.*

Inasmuch as there can be no definite line drawn between *Lunulites* and *Cupularia*, and because the latter generic name has been already employed in another way by D'Orbigny, I think it better to suppress the genus of *Cupularia* of Busk and regard them all as *Lunulites*. I do not think *Cupularia* can be maintained even as a sub-genus, because—as will appear when I come to deal with the genus *Lunulites* of Busk—the same individual may sometimes have the features of *Cupularia* in one part and those of *Lunulites* in another. In order, however, to correlate this part of my work with the labours of Busk I will keep the species separate according as they present the Cupularian or Lunulitic type.

Genus Lunulites, *Lamx.* (*Cupularia* of Busk.)

Avicularia accompanying every cell, but not disposed in lines.

Recent Species.

Lunulites (Cupularia) crassa, *Spec. nov.*

Pl. 1., fig 1a—1c.

Zoarium rather large orbicular, somewhat depressed, roundly conical, solid, thick, dull yellow, margins thick elevated. Zooœcia pyriform rounded, but very little elevated. Mouth pyriform with a raised margin, outside which there are irregular pores. Vibracular pore round, conspicuous, above narrow end of mouth. Under surface of zoarium, with an oblique margin of cells, the rest of the concave surface a

*Since the above was written a most interesting discovery of fossil species of *Catenicella* has been made in the Geelong Miocene beds.

spongy texture of large rounded granules, with pores (one or two) between them. Diameter, about 10 millimetres; height, about 4.

Dredged in April, 1857, by W. S. MacLeay, at 70 to 80 fathoms, off Cape Three Points, and Port Stephens, N.S.W. About a dozen specimens are in the Macleayan Museum.

The size, thickness, and the peculiar spongy surface of this form would distinguish it without a knowledge of the cells, which are also different from any of the species described.

Fossil Species.

LUNULITES (CUPULARIA) RUTELLA, *Spec. nov.*

Pl. I., fig. 2a—2d.

Zoarium irregularly orbicular, thin, much depressed. Zooœcia squamosely radiating, oval, somewhat depressed above, but elongating below into a projecting overlapping somewhat narrow rounded edge. Lamina immersed with two large pyriform pores at each side below, and two or three small rounded ones above. Margins thickened and raised. Avicular pores numerous, much smaller than the cells, elongately triangular, rounded at the apex, and a distinct raised margin. The whole surface finely granular and shining. Under surface with broad very irregular undulating uneven radiating sometimes bifurcating faintly granular ribs.

Locality and Horizon.—Muddy Creek Miocene beds, near Hamilton. Upper Murravian beds; and lower Aldinga marls (Prof. Tate).

This is one of the most elegant of our fossil species. The openings are so large and defined that without the assistance of a lens they can be discovered. The avicular pores are sometimes in a line for a series of three or four, but they are always interrupted and never in a regular line like *Lunulites*. The cells are not quincuncially arranged, so that the generic position of this species would be very doubtful. The under surface is similar to *Lunulites aperta*, and quite different from the usual kind of ornament at this part of the zoarium among Selenariadæ.

Genus LUNULITES, *Lamouroux.*

Cells arranged in more or less regular series radiating from the centre. Vibracula in linear series, alternating more or less regularly with those of the cells.

This definition, which is that of Busk, shows how very difficult it would be to draw a line between *Lunulites* and *Cupularia*. It seems to me that if the cells are quincuncially arranged the vibracular pores will not be in a line; but if not

quincuncially arranged the pores must be in a linear series. Such a distinction is very arbitrary, and may vary in the same species, or even in the same individual. I do not think the genus *Cupularia* can be maintained.

Recent Species.

LUNULITES ANGULOPORA, *Spec. nov.*

Plate I., fig. 3a—3c.

Zoarium small conical white, rather smooth. Zooœcia very minute, irregular, with an oblique mouth divided into two portions; one half triangular, constricted in the middle; the other semicircular—both with a raised margin, as well as the vibracular pores, which are long and narrow, and in a depressed area. The cells are obliquely placed; sometimes in contrary directions alternately. Base flat, with a margin of cell, and a centre of irregular porous or spongy structure; but the pores well defined, occasionally with a calcareous plate perforated with a ring of five or six pores, and a larger central one. Diameter and altitude about equal, from three to six millimetres.

Port Stephens, New South Wales.

Both the specimens in the Macleay Museum are worn, and the details of the structure of cells very difficult to make out. It is remotely like Busk's *L. Philippinensis*, but that seems to have been described and drawn from a much worn specimen.

Fossil Species.

LUNULITES APERTA, *Spec. nov.*

Plate I., fig. 4a—4c.

Zoarium large, orbicular (?), cup-shaped (?), depressed, thin. Zooœcia quadrangular, rather narrower below, perfectly open. Lamina, if any, worn away. Walls rather thick, regular, raised equally thick all round, with a cellular structure. Avicular pores oval, constricted in the middle, infundibuliform, margin pyriform. Under surface with broad flat irregular undulating costæ.

The cells, pores, and under surface of this fossil are quite distinct from the living and fossil forms already known. The specimen is very much worn, and is the only one seen by me.

Locality and Horizon.—Muddy Creek Miocene beds near Hamilton.

LUNULITES MAGNA, *Spec. nov.*

Pl. I, fig. 6a—6d.

Zoarium large conical thin, quite hollow beneath or encrusting; in the younger specimens (which are ten millimetres

high and broad), irregularly pentagonal ; in older specimens (twice the above dimensions) irregularly lobed or sinuated. Zoœcia small round projecting and irregularly pitted, or porous. Mouth circular with a raised margin. Vibracular pore oblique, pyriform with a raised margin, and a conspicuous bar across the centre. Under surface finely radiately ridged, with a long narrow slit-like pore at the margin.

Locality and Horizon.—Glauconitic limestone, Aldinga (Prof. Tate). I have also found the same species in the lower limestone beds at Mount Gambier. It is decidedly the largest species known, and is easily distinguished by its peculiar vibracular orifice.

LUNULITES EXIGUA, *Spec. nov.*

Pl. II., fig. 7a—7c.

Zoarium very small, thin scale-like, slightly convex, but depressed. Zoœcia minute in regular radiating, sometimes bifurcating, raised rounded lines. Mouth circular, large. Avicular cells in grooves between the lines of cells, lanceolate. Base quite concave, with lines of projections exactly corresponding with the zoœcia and avicular cells.

This species somewhat resembles the following *L. cupola* in the disposal of its cells and the avicularia, but it has a concave base, and the shape of both zoarium and zoœcia are different.

Locality and Horizon.—White polyzoal limestones at Mount Gambier (Prof. Tate).

LUNULITES CUPOLA, *Spec. nov.*

Pl. I., fig. 5a—5c.

Zoarium small, nearly circular, roundly conical. Zoœcia oval, flat round the margin, and regularly convex in the centre. Mouth in the lower part neatly defined, horseshoe shaped, with two small shifting oval protuberances on each side ; whole surface finely granular, edges overlapping the avicular grooves. Avicular pores parallel with the base of the cells, smaller than the apertures, elongately oval with a basal groove and two small processes projecting from the sides, so as to constrict the centre of the orifice, Base of zoarium quite flat, granular irregularly marked with grooves, which bifurcate at the edges, on which there are conical shaped hollows corresponding to half a cell area.

Locality and Horizon.—Muddy Creek Miocene beds, near Hamilton, Victoria.

Genus SELENARIA, *Busk.*

Only a certain number of cells, dispersed throughout the polyzoary, furnished with vibracula. The front of each cell

so furnished covered by a cribriform calcareous expansion, others arched above, contracted below. Under surface of zoarium marked with grooves.

This definition applies almost exclusively to the only species known to Mr. Busk. The cribriform calcareous expansion is not present in the species described here, and the generic character is confined to the fewness and irregularity of the pores.

Recent Species.

SELENARIA PUNCTATA, *Spec. nov.*

Pl. II., fig. 8a—8c.

Zoarium small orbicular or conical or roundly convex, somewhat thick, margins rounded thick, and almost flat, with open cells in worn specimens, of a dull greyish colour. Upper surface rough and spongy in appearance. Zooœcia ovate, angular at the sides, arched above, flat or curved below; but the form varies. Surface flat, with a raised margin; mouth rather large at base of cell, flat above, curved below, with two, rarely three, round pores above. Ooœcium rather larger than cells, ovate, rounded, adnate, punctured, opening above the mouth of underlying cell. Vibracular areas rather larger than mouth of cells, somewhat angular, with a raised margin. Under surface of zoarium forming rounded, raised costæ, with linear grooves between, with a single or double row of punctures. Some of these costæ continuous to the concave summit; others intercalated between, which terminate at various lengths in fine or obtuse points. These costæ do not bifurcate, though they have the appearance of doing so.

Diameter of zoarium from six to seven millimetres; altitude, three to four.

Dredged off Cape Three Points at 71 fathoms.

The small cells and the double pores above the mouth are sufficiently distinctive of the species, which is somewhat like the fossil *S. parvicella.*

SELENARIA MARGINATA, *Spec. nov.*

Pl. II., fig. 9a—9d.

Zoarium small, irregularly orbicular, depressed, rather thin, margins flattened for a long way, only concave near the centre; colour white, shining, upper surface rough and pitted. Zooœcia hexagonal or sometimes rounded below, often appearing as seen from above as if they overlapped like rounded scales. Depressed concave, with distinct, raised margins, covered with fine wart-like projections. Mouth large, quadrangular, with the angles rounded sometimes above and some-

times below; with elevated granular margins, and a large conspicuous pore in the centre. Vibracular cells few, irregular, sometimes with an avicular opening beneath, with well-defined raised margin. Under surface of zoarium with undulating, broad, flat, punctate costæ, bifurcating, with short blunt ribs intercalated, and all circumscribed by a distinct narrow raised margin. These costæ seem to correspond with the width of the cells, and on the edge they often correspond with the limits of a marginal cell.

Diameter, three and a half to six millimetres; altitude, one to two.

Dredged at 71 fathoms off Cape Three Points.

This species is distinct from *S. punctata* in many respects, but particularly in the one pore at the mouth of the deep cell, and in the margins round the flattened ribs at the side.

Fossil Species.

Selenaria parvicella, *Spec. nov.*

Pl. II., fig. 10a—10c.

Zoarium large, irregularly orbicular (?), very thin, depressed. Zooœcia small, horseshoe shaped, the round end below; walls thick, margins raised, lamina not visible. Avicular cells elongately pyriform; the apex above, narrow, immersed, with broad inner margin, very long, nearly equalling two cells. Under surface with numerous radiating depressed ribs, not bifurcating, but with undulating margins; and in the centre a single row of large pores, irregular in shape, size, and distance from one another.

The cells in this species vary much in size, and the peculiar vibracular cells are different in size and shape from any other species.

Locality and Horizon.—Muddy Creek Miocene beds, near Hamilton.

Selenaria concinna, *Spec. nov.*

Pl. II., fig. 11a—11e.

Zoarium small, thin, orbicular, very slightly convex, sometimes almost flat. Zooœcia quite concave. semicircular, the upper angles often circumscribed by the neighbouring cells. Surface finely granular, waxy, shining. Aperture elongately semicircular, the rounded basal edge encroaching on the low margin of the cell. Avicular cells about the size of the aperture, very narrow, oblong, or triangular, with the base above, the edges studded with very fine teeth. Under surface with radiating, flat, granular ribs, thickly beset with irregular

pores; between these ribs there are always fine raised lines, which branch two or three times towards the margin.

Diameter, four millimetres; altitude, one millimetre.

A peculiar and very neat form, very granular, and the granules projecting on the edges of the zoarium, like asperities. The avicular cells are edged with fine, sharp, spiny-like teeth, which almost close the aperture of the cells. This structure is quite unique in the genus. The zooœcia are all depressed, and do not project in any way, or overlap one another; but the surface is pitted, and appears without a lens somewhat like the top of a thimble.

Locality and Horizon.—Muddy Creek Miocene beds, near Hamilton.

Selenaria alata, *Spec. nov.*

Pl. II., fig. 12a—12c.

Zoarium rather large, orbicular, moderately convex, solid; edges thick, spongy. Zooœcia elongately semicircular, overlapping squamosely; margins distinct, raised; area depressed; aperture large, narrowed above by triangular alæ at each side. Avicular areas larger than zooœcia, very few in number, with a large ear-shaped pore in the midst of the area. Under surface very finely punctuate, with a few radiating fine grooves, forking two or three times towards margin, between which there are many large pores in a double or single line of irregular sizes and intervals.

Diameter, rather more than $6\frac{1}{2}$ millimetres; altitude, exceeding $2\frac{1}{2}$.

The cells are a little more constricted than they are represented in the drawing, and this I believe to be the distinction between this species and var. a, which I distinguish as var. *lata.*

Selenaria alata, var. lata, *nov.*

Zoarium small, orbicular, solid, moderately conical, the younger specimens most so, base flat. Zooœcia rhomboidal; margins raised; centre depressed with a very large oblong square opening with the angles rounded; the summit curved and the sides slightly constricted by the projection of the margin. Far back in the opening there is a large semicircular pore. The whole surface granular. Avicular pores very few in number, something like the cells in shape but smaller. Under surface with deep irregular grooves and pores of large sizes forming a pattern very like rustic work in architecture.

Diameter of zoarium, about four millimetres.

The shape of the aperture in this variety is very like *S. alata*

but more open. The flatness and peculiar ornamentation of the base distinguish it.

Locality and Horizon of the species and variety.—Muddy Creek Miocene beds, near Hamilton, Victoria.

EXPLANATION OF PLATES.

Plate I.

Fig. 1. *Lunulites (Cupularia) crassa:* *a*, zoœcia, magnified; *b*, portion of base, magnified: *c*, zoarium, natural size.

Fig 2. *Lunulites (Cupullaria) rutella:* letters as above.

Fig. 3. *Lunulites angulopora:* letters as above.

Fig. 4. *Lunulites aperta:* letters as above.

Fig. 5. *Lunulites cupola:* letters as above.

Fig. 6. *Lunulites magna:* *a*, *b*, zoarium, natural size; *c*, zoœcia, highly magnified; *d*, outline of base, natural size.

Plate II.

Fig. 7. *Lunulites exigua:* *a*, zoarium, much magnified; *b*, zoœcia, highly magnified; *c*, part of base, magnified.

Fig. 8. *Selenaria punctata:* *a*, zoœcia, and *b*, portion of under surface, much magnified; *c*, sections of two zoaria, natural sizes.

Fig. 9. *Selenaria marginata:* *a*, zoœcia, and *b*, portion of under surface much magnified; *c* and *d*, section and outline of zoarium, natural sizes.

Fig. 10. *Selenaria parvicella:* *a*, zoœcia, and *b*, portion of base, magnified; *c*, zoarium, natural size.

Fig. 11. *Selenaria concinna:* *a*, zoœcia, and *b*, portion of under surface, both magnified; *c*, a vibracular cell showing the peculiar teeth-like projections, much magnified; *d* and *e*, outline and sections of zoarium, natural sizes.

Fig. 12. *Selenaria alata:* *a*, zoœcia, highly magnified; *b*, part of base, magnified; *c*, zoarium, natural size.

Red Rust:

ITS NATURE, APPROXIMATE CAUSES, and PROBABLE CURE.

By Otto Tepper, F.L.S., London; Corresponding Member.

(Abridged.)

[Read November 1, 1879.]

The subject under consideration divides itself naturally into various questions, viz.:—

What is Red Red Rust, and how is it produced?

What laws govern its development, and the growth of its fostering plant?

What will check the one and promote the other?

That Red Rust, or mildew, is a fungus, alike with mould, smut, brand, &c., has been proved and known long ago. The reddish dust, which furnishes the name, is the accumulation of the spores or seed germs of the fungus, and its appearance denotes the last stage of its development and the completion thereof. The first plants upon which it appears (as frequently observed by me) are self-sown plants of black oats, barley, and wheat, in the order they are named, the first two being seldom and the latter not necessarily injured by it; one reason being that this, the first stage (for according to Mr. C. Cooke there are three or four) only attacks the older leaves in quite an inconspicuous manner, the few spots being overlooked and assigned to different causes by the practical farmer. Should the sown crop be attacked, the indications will appear in the same order—first by faint minute streaks upon the leaves and their sheaths, then on the portion of the stalk covered by the latter. These gradually augment, at the same time raising the cuticle or outer skin into minute longitudinal ridges and protuberances plainly discernible to the touch. These increase and finally burst almost spontaneously over vast areas, or only in limited localities, according to local climatal circumstances. Then only, when the fact thus forces itself upon the ordinary observer, is it noticed; but at this stage the mischief is done, and nothing can stay the consequent destruction of the crop.

Whence did it come? How did the destroyer get into the plant? To answer these questions, we must shortly consider the growth of fungi and their propagation.

All proceed from extremely minute bodies, termed spores, so small that thousands have to be placed in line to attain the extent of an inch, and are, therefore, singly quite invisible to the naked eye. Again, they are produced in such inconceivably large numbers that millions are said to be evolved from a single plant. Some float in the air constantly, and at all heights, assisting—Prof. Huxley suggests—in causing the blueness of the sky. Thus they are spread over the world, only awaiting a favourable opportunity to alight on a suitable host, where they germinate, grow, and give birth to millions more. Ordinary terrestrial heat little affects these spores, but myriads perish by moisture and warmth, causing germination when not near or upon a congenial plant; or the temperature may be below the limit proper to their development; or the cuticle of the plant may be too hard or too tough to be penetrated, for fungoids of this class only develop within the tissues of their hosts. Before describing the manner of the germination of spores, which differs widely from that of seeds proper, it must be remarked that many fungoids, as well as numerous animal parasites of low organization, undergo a two-fold development known as "alternation of generation," or "metagenesis," to which our Red Rust very probably is also subject. In this the rule that "like produces like" does not hold good, the spores of a fungus of definite forms infecting one plant not propagating upon the same, but upon a totally different one, and developing into a growth more or less different from its progenitor. The spores of this last, however, return to the former host and produce the original fungus in an analogous matter to "measles" in pork, entering the human frame and developing into the tapeworm, while the eggs of the latter swallowed by pigs infect them with measles. The best known instance of this, according to some authors, is that of the "fœtid smut"—*Tilletia caries (Uredo fœtida)*—which is said in its second form to propagate upon *Berberis vulgaris*, L., the eradication of this shrub in the vicinity of cornfields being followed by almost total disappearance of the said smut. The Red Rust appearing to belong to this class of fungoids, its second host is seemingly the so-called "barley grass," an introduced plant—(other grasses, several acacias, especially a species with greyish-green velvetty leaves growing near Callington, Truro, &c., are likewise strongly suspected)—which of late years has largely supplanted the native grasses, and upon which the rust appears before any other plant in the form of numerous brownish spots upon the leaves. This generally takes place in July, August, or September, sometimes earlier, sometimes later, according to the general temperature of the season. Should the ground be very moist, the weather at the time be

warm and genial—(a few frosty nights have little influence on the wheat, and none upon the fungus),—and gentle warm breezes prevail, the wheat plant grows rapidly and becomes very rank and succulent. The spores of the fungus escaping from the grass rise and are wafted upon the crop, adhering to the surface of the plant, which is then generally found to be slightly moist near the ground, and enter at once unseen and unsuspected upon their silent course of destruction As long as only the *leaves* of the plant (*i.e.*, wheat and other grasses) are attacked the effect upon the seeding process is comparatively insignificant; it only becomes serious when the stalk becomes affected to any considerable extent. We have, therefore, to consider the structure of this part of the wheat plant for a moment at this stage of our inquiry.

A very thin and smooth skin forms the outermost layer, immediately below which follows a layer of minute microscopical plates formed of pure silica (the same substance that forms quartz, flint, &c.), acting like a coat of mail in protecting the underlying delicate fibres, canals, and cells (containing the life-substance or protoplasm of the plant) while engaged in their office of nourishing and building up the body thereof. The edges of these stony plates are toothed and notched, and fit, in a normal state of health, closely into each other, thus giving strength to the stalk without rigidity, only leaving open exceedingly small apertures called stomata, pores or breathing holes, but much too small to allow any spores to enter. But if the plant be surcharged with sap, through super-abundant moisture in the ground, this, in combination with increased temperature, will result in swelling out the cellular tissues unduly, separating the edges of the armour plates and enlarging the various openings or pores. The spores of a fungus alighting upon the exterior of such a plant when moistened, at once begin to germinate. Their lower surface extends, tube-like, and pushes a fine point into the next pore or even pierces the softened cuticle, thus penetrating the intercellular spaces between the abnormally separated silicious plates. Through this delicate tube the contents of the spore follow, and the new life begins by the formation of a network of delicate fibres, called the *mycelium*, upon which in due time sporangia or sporebearers are formed. Analagous to many animal parasites, the fungoids do not kill or even seriously incommode their host for some time, the vital action of the more important organs being left almost undisturbed. But, as soon as the preliminaries for their own propagation are completed, all regard for their host ceases and operations are carried on at an accelerated rate.

The roots, &c., of the wheat plant have at this stage collected

and are still augmenting the peculiar ingredients for the formation of the seed. The plant is blooming, or near doing so; the ears, husk, and skin of the grains are formed, waiting to be fertilised and filled, when the fungus steps in and impedes or intercepts the process.

Its agents, the mycelium threads, are widely dispersed through the whole plant; they appropriate from the sap the ingredients suitable for themselves, swell greatly, and with the multitude of sporangia forming, choke the channels of the sap, preventing its ascent to the head, where it is required, and finally bursting the skin, the plant is prematurely killed, while the fungus, shedding myriads of spores, has completed its own cycle.

Should cold, calm, rainy weather prevail at the time the spores are shed from the intermediate plant (or, on the other hand, those of the first stage on the wheat or other plant), the chances are that the greater number of the spores will be washed down into the soil and perish for want of proper nourishment, few only reaching their destination to do any perceptible harm, although the wheat might be in a fitting condition to receive them. Again, should dry weather prevail, with only sufficient moisture in the ground to keep the wheat in a healthy state, the stalks, &c., would be healthy and able to prevent the entrance of the fungi. Yet, a few always escape destruction, or find a suitable host, and a single spore produces a progeny in one season to infect, under favourable circumstances, a whole field in the next.

The reason why barley, oats, and some other grasses are not affected at all, or only to a slight degree as far as their seeding is concerned, is to be sought for in the fact that their grains are nearly perfected before the fungus interferes by choking the sap-canals, the latter thus only appropriating their surplus of sap, while in the case of the wheat the fungus comes first. Another cause may be that neither barley nor oats have been so highly refined through artificial selection as wheat, and thus remain hardier.

The first time the writer observed Red Rust was in 1854-5, near Lyndoch, extending over irregular patches of ground of considerable extent. Where observed it developed most in soils rich in humus and clay, least on stiff loamy soils; again more so on land ploughed shallow than on deeply-ploughed ground; but this, most likely, depends upon the subsoil, which, at the spot referred to, was beyond the reach of the plough, and consisted of stiff yellow clay. Since then it has been noticed nearly every year to a greater or less extent, the writer having lived constantly among farmers and farms.

In 1862 rust was observed in the neighbourhood of Mount

Gambier, chiefly on rich, loose, black soil with much lime, limestone forming the subsoil, but very little could be noticed on sand. What is most notable is that a variety of wheat, called "creeping wheat," distinguished by very stiff, glassy, upright stalks, appeared to be much less affected, if at all, than any other kind. It also was the latest in ripening. These facts probably point an important moral.

In 1871-2 rust prevailed much in Monarto, chiefly on the best loamy or clayey soils with limestone or clay subsoil, while splendid grain was obtained on patches of very sandy soil, ploughed and sown hurriedly for want of time.

At New Mecklenburg wheat was found as rusty as elsewhere near a salt creek, the soil being surcharged with saline ingredients. At Ardrossan, Yorke's Peninsula, all the crops were much affected with rust in the past season, and no difference was observable between those bordering the seashore and those some miles inland. The soil is abundantly supplied with salt and lime.

The above observations are intended to show that rust occurs equally on all soils, and under very varied circumstances respecting locality and situation. They seem to prove that the occurrence of the fungus does not depend either on the soil or local circumstances, but more likely upon—(*a*) Particular atmospheric conditions. (*b*) The structure of the wheat-plant. (*c*) The constitution of the soil (that is the soluble salts it contains); and suggest the direction in which the remedies lie.

In respect of the first the power of man is inefficient to do much, except in so far as by planting forest trees extensively (say a strip around each field) he can, to a considerable extent, regulate the moisture in the soil, as they promote the infiltration and retention of the rainwater, and protect the land from injurious winds.

The structure of the plant and the constitution of the soil are much more in the power of man. What promises by far the best results is the production of a wheat plant combining a hard smooth stalk and a full fine grain. This will depend on the ingredients of the soil, the constitution of which is inevitably changed for the worse by cropping year after year, without returning to the soil in a suitable form the ingredients removed by the crops. To determine these is the province of the agricultural chemist. Wheat and all other grain crops require a great number of substances for the production of seeds; the absence or insufficiency of *any one of them* will cause weakness and sickening of the plant, expose it to the invidious attacks of its enemies, and ultimate decay and death. For the building up of the stalks, leaves, and husks soluble silicates besides the carbon (derived chiefly from the

atmosphere) are required. Their presence depends largely on decaying vegetable matter in the soil. Sulphates and phosphates of potash, soda, and lime, &c., are wanted for the formation of seeds.

Seeking for a remedy in another direction, there *may* be discovered a substance which, when applied to the soil, or the seeds, and imbibed by the plants, will act adversely to the growth of fungoids, in the same way as bluestone (sulphate of copper) checks the "Dust Brand" *(Ustilago segetum)*. Thus in "Rust, Smut, Mildew, and Mould," Mr. C. Cooke says, at page 81, "the spores of many species of fungi will not germinate after saturation with certain chemical solutions. One of the most successful remedies, and easy of application, is a strong solution of Glauber's salts, in which the seed corn is to be washed, and afterwards, while still moist, dusted over with quicklime. The rationale of this process consists in the setting free a caustic soda by the sulphuric acid of the Glauber's salt combining with the lime, and converting it into sulphate of lime. The caustic soda is fatal to the germination of the spore of 'bunt,' and probably also of smut and rust."

Notes on the Comet of February, 1880.

By C. Todd, C.M.G., F.R.A.S., Vice-President.

(Read March 2, 1880.)

[Plate III.]

You will no doubt expect to receive from me some account of the fine comet which during the first half of last month formed so conspicuous an object in our evening sky. I regret that I have not very much to tell you about it, and I fear I cannot tell you much more than you already know; but it is only proper that what little I have to say should appear on the records of this Society. Owing to the extreme faintness of the nucleus, and its low altitude at first, very few measurements could be taken, and these extend over so short an interval as to afford no data for determining even approximately its orbit. My friend Mr. Ellery succeeded in getting measures on February 9, 10, 14, 15, 16, and 17, and glimpsed it on the 6th and 13th. I obtained measures on the 12th, 13th, 16th, and 17th, and I just glimpsed it on the 18th; but thin clouds and bright moonlight prevented any observations of its position being taken. This, I believe, was the last occasion on which it was seen in Australia, the increasing moonlight on the next evening completely blotting out so faint an object, although I made a long and keen search for it with the telescope directed over the spot in the sky in which I knew the nucleus to be situated. Mr. Russell, the Government Astronomer in Sydney, who possesses a splendid equatorial, with an object glass of over eleven inches aperture, by Schroeder, only saw the nucleus twice for short intervals between clouds on the 13th and 14th; and Mr. Tebbutt, of Windsor, N.S.W., whom you all know as an ardent and experienced observer, writes me to say that owing to clouds he has been unable to see the nucleus at all. I mention these circumstances partly because you will no doubt have seen remarks complaining of the little information I gave the public respecting the comet, and reproaching me for not sooner detecting the nucleus. I think what I have told you will suffice to show that the nucleus was not a very easy thing to see, especially when it was low down in the mists of the horizon, and the atmosphere on the horizon

was very thick and unfavourable for the week or ten days after the tail was first seen. It happened, too, unfortunately that I was all alone; the Assistant Astronomer, Mr. Ringwood, being absent in Tasmania, and only returned on the morning of the 16th. On the five evenings on which I saw the nucleus it was too faint to bear any illumination of the field, and in taking the measurements I had to bring it to the edge of the comb of a bifilar micrometer, using a very low power; the observing-room was also kept dark.

In the accompanying map (plate III.) I have laid down approximately the path of the comet between the 2nd and 17th of February, and the position of the tail amongst the stars. The first thing that will strike you on looking at this diagram will be the rapid extension of the tail, which, within a few evenings from its first appearance, lengthened out from an altitude of about 15 deg. or 20 deg., up to within a short distance of the zenith. The rapid manner, too, in which it finally faded away, leaving the small faint nebulous nucleus with scarcely a trace of a tail after the 14th, was very remarkable.

On the 16th and 17th I could see no tail through the equatorial, the nucleus being reduced to a mere hazy speck. The length and brightness of the tail led me to expect a bright and large nucleus; but on the 6th, when it was first caught sight of by Mr. Ellery, it was so faint as to leave some doubts as to its identity. Mr. Ellery, in his telegram to me, says:—"Faint nebulous point, perhaps nucleus, observed last night (the 6th) R.A. 22° 48′, dec. 32° 36′."

The tail I considered was brightest on the evening of the 2nd, when I first saw it. It then appeared as a narrow auroral-like streak of light, extending from the mists on the horizon, perhaps a little N. of S.W., up to and passing nearly through *Delta* 1 and *Delta* 2, and *Beta* Gruis, the upper extremity, from about *Delta* Gruis, curving sharply to the south. On the following evening, the 3rd, clouds hung about the S.W., obscuring the view; but as they cleared off, the tail was well seen. It was somewhat broader than on the 2nd, and perhaps a little brighter than the Nubecula Minor, but not so bright as the larger Magellan cloud. Roughly speaking, the tail had shifted about 3° to the north, the stars *Theta* and *Iota* Gruis lying on the northern edges of the tail, which in its curvature was nearly concentric, with a line passing through *Delta* 1, *Delta* 2, *Beta*, and *Epsilon* Gruis, extending, as far as my eye could trace it, to an altitude of about 27°. A low bank of cloud cut off the view of the lower portion or head of the comet, which was probably not far from *Beta* Pisces Australis, at the time hid by cloud. I see I made a note that the tail was brighter than on the 2nd, but this I think was due to its greater altitude, its

greater breadth, and perhaps also to contrast with the dark clouds. I saw it on the 2nd, first in strong twilight, and for some time took it to be an auroral streak, till its fixity and freedom from pulsation indicated its true character. I may here say that the comet appears to have been seen by several persons on Sunday evening, the 1st, and by Mr. Blessing, of Seppeltsfield, on Saturday, the 31st of January.

On the 4th I saw the tail as early as 8 o'clock, and later, when the twilight had died out, it was very bright. I could trace it down to *Beta* Pisces Australis, which star was near the extremity, on the northern edge; but I thought wholly immersed in the tail.* In this position *Beta* Pisces Australis was probably mistaken by many persons for the nucleus, of which, however, I could see no trace. The tail could be followed nearly up to and pointed directly towards *Eta* Phœnicis, or to an altitude of 35°. Better eyes could probably trace it further. *Theta* Phœnicis was within, but nearly on the northern verge, and the tail was broadest and brightest a little below that star —about 1½° wide, gradually tapering towards each extremity. The tail was about as bright, or a little brighter, than the smaller Magellan cloud, which in structure it much resembled, and could be seen much better with the naked eye than through a telescope.

On February 5 the tail was not so bright; first seen about 8.10; later it reached up to *Zeta* Phœnicis, say 40° or beyond, passing through *Epsilon* Phœnicis, the head being to the south of Fomalhaut. It was only slightly curved to the south, the upper end straightening as the tail swings over to the north.

Feb. 6. Fainter and less curved. Now extends to *Chi* Eridani, perhaps further. Air thick on horizon.

Mr. Mann, telegraphing from Mount Gambier, thus describes its appearance this evening:—

"Feb. 6, midnight. Beautiful clear night. I went to the top of the mount near the lakes to observe the comet. It has no nucleus, but tail fades away at some distance above the horizon (*i.e.*, cannot be traced down to horizon). At 10h. 30m. tail scarcely visible, and gradually faded away; position, S.W. by S. When at its brightest about 9 o'clock it extended over about one-fifth of the sky. At no time was the tail well

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* Dr. Bone, of Castlemaine, in Victoria, claims to have seen the nucleus with a field-glass on the 4th, and gives its position R.A. 22h. 49m. 5s., dec. 33° 35′. This would bring it close to *Gamma* and *Delta* Pisces Australis (R.A. 22h. 45m. 38s., and 22h. 49m. 5s., and dec. respectively 33° 11′ and 33° 30½′). The position given by Mr. Ellery on the 4th was R.A. 22h. 48m., dec. 32° 36′. Dr. Bone's position is either wrong, or he must have mistaken some star for the nucleus, and if so it was probably either *Gamma* or *Delta* Pisces Australis.

defined, but appeared more like nebulæ or a bright auroral streak."

The comet was seen this evening (6th) at the telegraph station on the River Katherine, in the Northern Territory, by Mr. Murray; also at Pine Creek, and by Mr. Little at Port Darwin. I telegraphed its position to Singapore, but it was not, I think, seen there.

On Feb. 7 the tail was much fainter and reduced to a thin nebulous streak, extending from a little above Fomalhaut up to *Kappa* Eridani, passing through *Alpha* Phœnicis.

Feb. 8. Comet fainter, and now has a slight curvature northwards. Can be traced from a little north of Fomalhaut, past and north of *Alpha* Phœnicis, and *Gamma* Phœnicis being on the northern edge, up to and pointing a little north of *Kappa* Eridani. I lost it a little beyond that star, but Mr. Cooke could trace it up nearly to the zenith.

Feb. 9. Looked carefully for nucleus, but could not see it. A bank of stratus below Fomalhaut on S.W. horizon, and atmosphere thick. The tail now passes a little north of *s* and *e* Phœnicis, a little south of *Delta* and *Epsilon* Eridani, above which I lost it, but my young assistant, Mr. Cooke, who has very sharp eyes, said he could trace it nearly up to the four stars, *Alpha*, *Epsilon*, *Beta*, and *Gamma* Columbæ (a short distance west of the zenith), towards which it points.

No special notes were made on the 10th and 11th, except that the tail was rapidly getting fainter.

On the 12th I succeeded in detecting the nucleus, and got some differential measurements in R.A. and Dec., comparing it with a star of $5\frac{1}{2}$ magnitude, No. 103 in the British Association's Catalogue (29 in the Melbourne Catalogue), and a small star of the 10th or 10-11th magnitude, being one of four small stars forming a pretty trapezium in Sculptor, which were in the same field as the nucleus, and to the south of the comet. The nucleus was a faint nebulosity. I could see no central condensation, and could only just trace the tail in the field of the equatorial finder, although it could be seen with the eye as a faint streak of light in the sky. At 10h. 1m. the comet followed B.A.C. 103; 2m. 22s. and 14m. further south in declination. Its approximate position, therefore, was R.A. 0h. 24m. 18s.; Dec. 33° 55′ south.

On the 13th I again got some good measurements, using a star of the 8th magnitude, which I have not found in any catalogue, and whose place, therefore, will have to be obtained with a transit circle on the meridian.

The comet at 9h. 27m. followed the star 2m. 24s., and was 10′ to the south in declination.

A good series of measures was obtained by me again on the evenings of the 16th and 17th.

On the former evening it was compared with B.A.C. 489, from which its approximate position was found to be

R.A., 1h. 29m. 26s. } at 10h. 1m.
Dec., 31° 21′ south }

On that evening I thought I could occasionally see a slight stellar condensation, but this was not confirmed on the following evening, when its appearance in the 8-inch equatorial was that of a faint nebulous telescopic comet, without any defined nucleus. As I have before said, it would bear no illumination of the field, and the measures were taken at the comb of the micrometer. The tail could at times be just traced in the field as a slight elongation of the nebula. The reference star used on the 17th was Lacaille No. 522. It cannot be found in any other or modern catalogue, and its position, therefore, requires verification. The approximate place of the comet deduced from fourteen measures in R.A, and ten in declination was—R.A., 1h. 41m. 16s.; Dec., 30° 18′ at 10h. 5m.

I have been unable to identify the comet with any previous one. No orbit has been calculated, and in fact the few observations we have obtained are insufficient to give more than a very rough approximation to its path. Whether, therefore, it is a new friend or a regular denizen of our system I cannot say.

With comets, as you are aware, the space through which we can follow them is often too limited to enable us to deduce an elliptical orbit. A parabola, and in some instances an hyperbola, will satisfy all the observations, and in that case no period of revolution can be obtained; in other words, we cannot say whether the comet will soon return to us, or whether it will go on to other systems far away in the infinite space by which we are surrounded. We are, however, helped by knowing the velocity of its motion. For instance, it has been shown that if a comet at a distance from the sun of about 92,000,000 travelled at a rate of 26 miles a second, it would describe a parabola; and, therefore, unless arrested in its course by the action of one or more of the larger planets, it would never return.

Many comets to which a parabolic orbit has been assigned no doubt move in very elongated ellipses, and will and do return to us after long intervals.

Now, the position of a comet's orbit in space is fixed:—

1. By the inclination of the orbit to the ecliptic.
2. The points of intersection with that plane—*i.e.*, the longitude of its ascending and descending nodes.
3. The longitude of perihelion.

4. The distance of the comet from the sun when in perihelion.

To which may be added as a further means of identification, whether the direction of its motion is direct or retrograde.

In catalogues of comets these elements are given, and when any new comet comes into view, and the elements of its orbit are determined from the observations made, we can compare these elements with those of older comets, and thus ascertain whether it has ever been seen before.

Bright comets have been regarded by the ancients with awe and dread, and thus influenced they have fortunately left us pretty reliable records of their apparitions, and from these Mr. Hind was able to trace successive appearances of Halley's comet—which we last saw in 1835 and '36—as far back as 11 B.C., and in A.D. 65 it hung as an avenging sword over Jerusalem, then besieged by Titus.

In like manner the splendid comet of 1680 was identified, with some degree of probability, with the comets of 531 and 1106, and the year of Cæsar's death.

With regard to the comet of this year I find that the longitude of its ascending node is about 123°, and the inclination to the ecliptic about 38°. It probably passed its perihelion at the end of January. Its motion is direct.

Mr. Jones, of Gawler, says he first saw what he believes to be the same comet some weeks earlier. It was then—(I use his own words as published in the papers)—mistaken for a nebulous star about 8° east of the Nubecula Minor, and that three days later the same object was 2° to the eastward, had become brighter, and had assumed an oval configuration. I fail to identify this object with our recent visitor, and must express my regret that Mr. Jones did not announce his discovery of a new comet at the time. I shall be glad now to receive particulars of his observations. Mr. Jones further appears to think that the comet of 1880 and Faye's comet are one and the same. Now, I was fortunate enough to observe Faye's comet in 1850 and 1851 at Cambridge. We were the first to re-discover it on November 28, 1850, and followed it up till the month of March following. It was excessively faint, even through the twelve-inch Northumberland telescope, and was, I think, seen at only two other observatories—Cambridge, in America (where they got two observations), and at Berlin. It bears no resemblance to the late comet, and has a different orbit. It reaches its perihelion in November this year.

ON THE CHARACTERISTICS AND DISTRIBUTION OF THE NATIVE AND NATURALISED PLANTS ABOUT ARDROSSAN, YORKE'S PENINSULA.

By Otto Tepper, F.L.S., Corr. Member.

[Read April 6, 1880.]

[Plate IV.]

At the desire of the eminent botanist, Baron F. von Mueller, K.C.M.G., M. & Ph. D., F.R.S., Melbourne, I commenced in the second half of last year to utilise some of my leisure by collecting the plants of the neighbourhood of Ardrossan, with the view thereby to elucidate the floral aspect of the Peninsula, as a narrowly circumscribed and almost isolated area. Being limited in time and means of locomotion, the area examined is necessarily small, mainly comprised within a radius of three or four miles. A few excursions have been made to Yorke Valley (two miles E. of Maitland) near the middle of the Peninsula, and one to Kilkerran and the West Coast, in which I was greatly assisted by Mr. Wundersitz, to whose kindness my best thanks are due. Another excursion was made to Muloowurtie and Pine Point, but rather too late in the season. A few plants were obtained from Kalkabury, 14 miles N.W. from here.

The dried specimens were forwarded to Baron F. v. Mueller, who most obligingly named them, and afterwards revised their arrangement. Considering the labour this entails, and the increased scientific value it gives to the work, great thanks are due to the honorary member.

The accompanying "List of Plants" represents the results of the undertaking; but the whole of the Acotyledones are omitted on account of incompleteness, with the exceptions of the Filices and Musci (four species), which I believe are all that occur in the area examined.

To the names of the plants are attached certain letters indicating the geological formations to which they most pre-

vailingly [are peculiar, and the meaning of which is explained in the table showing their numerical relation. The term "coast" includes the sea-beach as well as the adjoining plain. The soil of the latter consists everywhere of an arenaceous, somewhat saline clay, derived partly from tertiary and partly from primary, or even plutonic rocks, and covers (in variable dimensions) loose, globular limestone concretions. Some plants, characteristic of certain formations, mark this conspicuously; for example, the native tobacco, *Nicotiana suaveolens*, Lehmann, which flourishes on soil derived from primary rocks in the North, occurs here among the sandstones and marbles of the hills near Ardrossan, but accompanies the debris along the gullies to within a few yards of the sea shore. This seems the case also with other formations, which largely explains the sometimes strange intermixture of plants. But it appears to me that plants prefer certain rocks less for their chemical than for their physical properties; thus plants affecting tertiary soils, such as *Calycothrix tetragona* seem to cling as well to the newer, loose aggregated limestones as to the silicious grits, while the dense travertines are associated mostly with the same plants that grow beside primary conglomerates, schists and granite. Of these I mention *Myoporum viscosum* and *Dodonæa viscosum*. By the term "general" (G.) those plants are denoted which flourish indiscriminately on all formations, provided the conditions of the surface soil be favourable to vegetable growth. Examples in point are our two principal mallees, *Eucalyptus oleosa* and *E. gracilis*, which cover the greatest area of the Peninsula. Others are most grasses, several Goodenias, *Dampiera rosmarinifolia*, *Bursaria spinosa*, *Wahlenbergia gracilis*, and almost all introduced weeds.

A few words about the lateral arrangement of the geological features may not prove superfluous in rendering the following remarks more lucid. The appended diagramatic section (Plate IV.) illustrates roughly the configuration of the Peninsula from Ardrossan westward to Point Pearce Peninsula. The distance from sea to sea is about 26 miles, and the greatest elevation is attained by the double ridge at Maitland, between which is Yorke Valley. The heights in the sketch, which are much exaggerated, are about 300 feet in elevation, those at Maitland probably above, and those at Ardrossan below the average. The chief geological features are indicated in the sketch. The width of the Ardrossan coast-plain is about a mile; that of Kilkerran two or three miles. The tertiaries form narrow bands on the east coast, not exceeding a few hundred yards in width, near the summit of the hills and following their convolutions. Those on the west coast are only inferred from the vegetation, &c., and form a belt some two or

three miles across. The soil covering the several formations is everywhere a more or less sandy clay, rarely replaced by pure sand, with this difference in the substratum, that the loose limestone concretions on the newer are replaced by a solid travertine on the older formations, the respective rocks only protruding at rare and wide intervals, just about sufficient to surmise the real nature thereof. It will be noticed by the diagram that the primaries occupy by far the largest area. They consist chiefly of granite, gneiss, quartzites, sandstones, and conglomerates from the Ardrossan to the first medial ridge. This fact partly accounts for the monotony and poverty of the vegetation, especially if it be remembered that the physical properties of the limestones favor a rapid percolation of the rainwater, thus producing a scarcity or rather absence of surface moisture. At Yorke Valley and west of Maitland a more tenacious and retentive clay prevails (probably derived from decaying *slates*), and consequently vegetation is much more luxuriant.

A few words on the temperature and other meteorological relations may not be amiss. As to the first, the observations scarcely extend beyond the neighbourhood of Ardrossan, and appears to be similar as at Port Adelaide and the Semaphore. In winter it is mild, frost is scarcely known, and the thermometer is seldom less than 55° F. in the daytime. In summer it has been observed as high as 116° in the shade (19/1/80), but the nights are always cool. The annual rainfall is about equal to the average of the province; rain falls frequently, but generally light, and of short duration. The winds seem more regular than on the main land. During the warmer season the cool south-east is the most prevailing; it is ever accompanied by dry and fair weather. In winter and early spring the south-west bears sway, generally dry; it sometimes brings heavy showers, and is always cold and bracing. The north-west winds are not very frequent, even in summer, when they are as hot as elsewhere; but in their train ever comes a speedy change and often rain; in fact, they are the true rain winds, as far as steadiness and continuity goes. The rarest winds are those from the east, very cold and cutting, and when accompanied with rain Australians *do* feel it cold. The changes in the weather, in the whole, appear to occur very regularly in the following sequence :—S.E., cool, fair, dry; E., cold and dry, sometimes drifting rain; N.E. and N., hot, sultry, dry, cumulus clouds gathering, either followed by steady rain, the wind gradually shifting through W. to S.W., with the rain breaking up into showers, frequently very heavy; or the wind suddenly shifting to the S.W., driving clouds of dust before it, and cooling the air within an hour or less from 116° down to

70° or less, in which case no rain follows except some light local thundershowers.

Whirlwinds are very rare about Ardrossan (this place is about 45 miles north-east of Port Adelaide).

During the prevalence of north-east and north-west winds the shores of the mainland can be plainly discerned, sometimes in curiously distorted outlines (25th August, 1879), and then the Port Adelaide Light is seen distinctly at night, which is not the case when the south-east, south, and south-west winds blow. The distance between the shores of St. Vincent's Gulf at Ardrossan varies from 20 to 35miles.

The total number of species contained in the list amounts to 363, exclusive of eight remarkable and well-defined varieties, comprised in 206 genera and 67 orders. Most of them have been gathered around the port of Ardrossan. Of those obtained elsewhere, the name of the locality has been appended to the name; thus 30 are recorded as peculiar to Yorke Valley and the adjoining hills to the east; twelve from Kilkerran; nine from Muloowurtie; and twelve from Maitland Road, by which is meant the low tract of ground between the Ardrossan and Yorke Valley ridge of hills.

The following table indicates the geological distribution of plants, according to the present state of inquiry:—

Formation.	Abbreviat.	Dicotyled.	Monocotyl.	Acotyled.	Total.
Coast and Coastplain .	C.	74	14	1	89
Coastplain & Tertiaries	C. and T.	27	12	0	39
Tertiaries	T.	21	4	0	25
Tertiaries & Primaries	T. and P.	32	3	0	35
Primaries	P.	81	11	1	93
Common to all, general	G.	70	19	2	91
Uncertain	—	1	1	0	2
Total	.. ..	303 incl. 8 var.	64	4	371

It will be seen that the coastlands furnish the greatest number of species, viz., 208, or about 61 per cent.; the tertiaries the smallest, with 184, and the primaries with 204, seeming somewhat richer. But the aspect changes, when we consider the respective areas occupied. Then we see at a glance that for any given *equal* extent the tertiaries present the greatest variety, especially if we consider the eastern coast-*plain* as belonging to the tertiaries *under the influence of the*

sea air (for which there are good reasons). Under this view the scantiness and monotony of the primary regions will fully reveal itself, as many of their peculiar forms of vegetation are very local, and frequently of solitary occurrence.

The aspect of the plant world of Yorke's Peninsula in the whole much resembles that of portions of the Murray Scrub between Callington and Swanport, and bears a decided desert character between Ardrossan, Yorke Valley, and Kalkabury, and again some portions of Kilkerran, brought about by the total absence of natural springs and flowing water, and the permeability of the soil. The coast-plain and other open patches are thickly studded with large tufts of grass-like *Cyperaceæ* and *Xerotideæ*. The most common is *Cladium lanigerum*, with cylindrical, needle-like, pungent leaves, associated with four species of *Xerotes* and one of *Lepidosperma* (undetermined), the latter distinguished from the preceding by its flat, leaf-like flower-stalk. The most common of the *Xerotids* is *X. effusa*. All these are almost useless as food for domestic animals, and lend to the landscape a weird, forbidding aspect. Among their tufts other grasses find a precarious domicile, of which *Stipa scabra*, *S. crinita*, *Danthonia penicillata*, *Poa caespitosa*, and *Agropyrum scabrum* are the most conspicuous, together with the introduced *Festuca bromoides*, *Koeleria phleoides*, and *Hordeum murinum*. *Anthistiria ciliata*, the "kangaroo grass," is in the whole very scarce. Wherever a fire sweeps away the scrub, *Stipa semibarbata* and *S. aristiglumis* appear in profusion, often growing a stalk three to five feet high, producing a singular effect at certain seasons by their large waving seed-plumes. During the season of spring these grasslands are enlivened by the thousands of yellow and white flowers of many Composites, Goodenovieæ, and Orchids, the blue of *Wahlenbergia gracilis*, the blue or pink of *Dampiera rosmarinifolia*, and many others; few only, among which is *Stackhousia linarifolia*, being at all remarkable for any pleasant scent. Of shrubs, dotting the open country near Ardrossan, &c., the most remarkable are the low, dense *Styphelia patula*, with dark green, glabrous, myrtle-like leaves and red edible berries; *Hakea rugosa* and the unavoidable *Bursaria spinosa*, with its large white clusters of snow-white flowers, but very spiny branches.

Grevillea Huegeli and a variety of *Eremophila Brownii*, both with fine red flowers, occasionally find their way from the hills to the plain, increasing the variety agreeably in company with the much smaller *Pimeleas*, dressed in a profusion of white or yellow. Larger shrubs are *Acacia Osswaldi*, with rigid dense foliage, semi-arborescent, and *Geijera parviflora*, many stemmed, with dense light green foliage, steeped from September to

November in a cloud of delicate white bloom. *Melaleuca acuminata* and *M. ericifolia* form occasionally dense thickets, but the latter only in company of mallee wherever it approaches the shore. This is the largest of its kind here, mostly forming arborescent shrubs, eminently social, and covering considerable tracts almost exclusively, but also growing into trees some ten or fifteen feet high. It likewise flourishes on the Muloowurtie Hills (Ardrossan marble). Upon it *Loranthus Melaleucæ* is found parasitically; at the last mentioned locality profusely; near Ardrossan seldom. On dry watercourses the graceful *Eremophila longifolia* is sometimes met with. It is a tree about ten or twelve feet high, with pendent branches and large yellowish red flowers in great number; also groups of *Scaevola spinescens* and *Lycium australe* occur; the former often infested with hairy galls, looking like tufts of white wool. The mallee-scrub—here principally formed of only two species, *Eucalyptus oleosa* and *E. gracilis;* while another, *E. uncinata*, is more local—covers the greater part of the interior, sometimes extending to the very edge of the shore cliffs, either for some distance or only lining the banks of watercourses. In its company is then found the fine ornamental shrub, *Alyxia buxifolia*, with dark green glabrous leaves (whitish yellow when young), white spiral flowers, and bright red berries. The latter are very attractive for the eye, but obnoxious to the taste. This shrub sometimes forms close thickets, even on the incline of the shore. The native peach, *Santalum acuminatum*, and the popularly termed "poison tree," *Pittosporum phillyræoides*, are plentiful. The profuse red or orange coloured berries of the latter are bitter, but not poisonous; thus the popular name is a misnomer.

A remarkable plant is *Exocarpus aphylla*, which seems to represent savage obduracy as a shrub, with inextricably intertwined stems and branches, no leaves, thickly-set thousands of minute flowerets, and abominably bitter red berries; and as a stunted tree, appears to picture, with its pendent, stiff, dead-looking branches, the hopeless despair of one lost in these dreary thickets. At the foot and along the face of the cliffs, wherever offering a hold, *Atriplex cinereus*, *Nitraria Schoberi*, and *Tetragonia implexicome*, with other salsolaceous plants, *Myoporum insulare* and *Aster axillaris* flourish. The last is a tall shrub and forms large thickets, with *Bursaria spinosa* in sandy beaches, beyond the reach of high water, occasionally interspersed with *Casuarina quadrivalvis*, and (but rarely) *Frenela verrucosa*, which latter prefers higher sandy or rocky soil generally. Wherever the scanty surface-waters of the land find exit at the foot of the cliffs under the sea sand, *Scirpus nodosus* indicates its existence, while the drier dunes are fixed by the rami-

fying stems and roots of *Spinifex hirsutus* and *Distichlis maritima*.

Receding from the shore and ascending the hills the aspect of the plant world gradually changes. One of the most lovely of shrubs is *Boronia clavellifolia*, with its hundreds of bright pink flowers—blooming for many weeks ; it would grace any garden. Other plants deserving the attention of horticulturists are *Halgania lavandulacea* (yellow), *Eriosteman lepidotus* (blue), *Westringia rigida* (white), *Prostanthera coccinea* (varying from light yellow through grass green into dark bluish green), *Baeckia crassifolia* (white), *Cheiranthera linearis* (beautifully blue with yellow stamens, about one inch, and easily cultivated), *Lasiopetalum discolor* (pink), *Callistemon coccineus* (growing in and around claypans, and requiring stiff clay with fragments of granite, the flower cluster is two to three inches long, and of bright crimson), *Aster pannosus*, and others too numerous to mention here. As climbers may be recommended the silvery *Billardiera cymosa*, var. *sericophora*, with profuse rather large whitish flowers, the almost leafless *Comesperma volubile*, with large clusters of sky-blue or purple flowers, and the chaste *Clematis microphylla*, the latter very easy to grow.

Everywhere the tops of the mallees are interwoven with a plant with cord-like stems and branches, very minute leaves, small white flowers and greenish globular berries, rendering some parts almost impenetrable. This is *Cassytha melantha*. Another smaller species, *C. pubescens*, also epiphytal like the preceding, with truncated elliptical berries, prefers smaller shrubs. A third species, *C. glabella*, with a stem hardly thicker than a thread,, but yet several feet long, infests species of *Cladium* and *Xerotes* preferentially, but fastens on almost anything in its way. It is chiefly found on the coast-plain and other open tracts.

Some plants appear characteristic of certain formations. Thus *Hibbertia stricta*, *Pomaderris obcordata*, *Lasiopetalum discolor*, and the lowly *Melaleuca parviflora* appear confined to the tertiaries ; the delicate *Calycothrix tetragona* flourishes most profusely where these join the primary sandstones and conglomerates, while the latter are signalised by *Dodonæa hexandra*, a small, dense. light green shrub. *Dodonæa viscosa* has been almost invariably observed in connection with quartzites elsewhere; here this arborescent shrub (the "Native Hop") remains true to this character, but also locally appears on the very silicious Turritella Grits (tertiary) in a dwarf form, with broader leaves than usual. *Melaleuca uncinata* was ever noticed upon granite hills in the Murray Scrub at Monarto. Its appearance here induced me to infer the existence of granite long before it was actually observed.

It also flourishes on adjacent gneiss, but wherever seen it seems to indicate the said rock in close proximity. The settlers call it "broom," and we use it for covering sheds, &c. *Exocarpus spartea*, among others, is also found in the primary regions chiefly.

There are some plants very remarkable for their variability. Foremost among them is *Eutaxia empetrifolia*. The typical form is a low shrub, with very small pointed leaves, not very closely set, the branchlets almost at right angles; its yellow flowers have numerous dark streaks. The whole shrub seldom exceeds twelve inches in height; the stem is rarely thicker than a goosequill, and is found on all formations. Near the Parara Mine, on ferruginous micaceous schist, it appears in a totally different form, entirely prostrate, and closely pressed to the ground. The longer, narrower leaves are densely crowded along the numerous short branchlets, the flowers much more numerous and larger, and the whole plant presenting quite a different aspect. Along the Maitland road, on granitic or quartzitic soil, it assumes a much larger form, attaining from two to three feet in height. The branchlets are not numerous, very supple and thin; the leaves soft, and about a quarter to half an inch long; the flowers of a pale yellow. It frequently grows side by side with the first mentioned form, thereby forcibly exhibiting the great contrast between them. To this large form the name *Sclerothamnus diffusus* had been given, but it has been reduced to the rank of a variety, on account, as Baron F. v. Mueller says, of numerous insensible gradations from one into the other having been discovered at different localities. *Wahlenbergia gracilis*, the "native bluebell," varies in size from two inches high and a minute floweret (var. *quadrifida*) to fifteen or sixteen inches in height, and a usually blue flower of more than an inch in diameter. A large white flowering variety occurs here. Besides the difference in the flower, the form of the leaves also varies greatly.

Vittadinia australis, common everywhere on open ground, presents at least four well-marked varieties in flower and leaf. The leaves of the typical *Billardiera cymosa* are smooth and dark green, whereas those of the variety *sericophora* are densely covered with white hairs on both sides.

Of other notable forms either in flowers or leaf, the most conspicuous are *Comesperma volubilis*, *Prostanthera coccinea*, and *Eremophila Brownii*. Of variable Orchids may be mentioned *Caladenia pulcherrima*, of which *C. Patersoni*, R. Br., is one variety, but three others occur, different in colour and form. *Caladenia deformis* varies in colour from blue to pink.

Only one new species has as yet been discovered by me, viz., a small Orchid, in respect of which Baron F. v. Mueller, has

done me the honour of naming it *Prasophyllum Tepperi*. Its stalk is thin, straight, leafless; the flowers not numerous, very small; the tubers large, globular. It grows under clumps of mallee, and appears common to the tertiary and primary clays. It is rare, and blooms in April.

Plagianthus Berthæ has hitherto only been found between King George's Sound and the Australian Bight, and there it is rare, as Baron F. v. Mueller informed me. It occurs about four miles west of Ardrossan on the south side of the Maitland road for a distance of about two miles pretty plentifully, in company of *Eriostemon lepidotus* and *Halgania lavandulacea*. *Helipterum heteranthum* had also hitherto been known from W. Australia only; it is a small plant and of rare occurrence. *Thysanotus exasperatus* and *Pterostylis barbata* were only known from one spot each in South Australia, the former from the Flinders Range, the latter from near Mount Lofty; both grow here in the scrub, near Yorke Valley, but scantily. *Swainsona laxa*, R. Br., on the contrary, is an example of a plant hitherto not known to occur so far westward. It is a pretty plant, and has only been seen in the limestone gorge formed by Rogue's Gully in the Muloowurtie hills. Other plants, the localities of which are mentioned as new by Baron F. v. Mueller, are *Dodonæa hexandra*, *Melaleuca acuminata*, *Goodenia albiflora*, at Kalkabury; *Hibiscus Wrayæ*, at Kilkerran; *Daviesia genistifolia*, low ground on the Maitland road; *Hydrocotyle capillaris*, *Didiscus cyanopetalus*, *Minuria suædifolia* (the last three small herbs), and *Poa lepida*, a small but pretty grass and rather rare. *Templetonia sulcata* is, besides, remarkable for its leafless, flattened, brittle, light green branches. It occurs only on rich clay soil.

Of naturalised weeds 33 are enumerated as observed and collected. Some of them are happily of rare occurrence as yet; for example, *Xanthium spinosum*, the Bathurst burr, and the common Scotch thistle, *Onopordon Acanthium*. Others form good food for cattle, as *Medicago denticulata* (wild clover), and *Polygonum aviculare*. In respect of a few I feel inclined to consider them rather as cosmopolitan vagrants than as introduced forms, having known them 30 years ago as plentiful as now among the true native flora. That they have become more conspicuous I think is greatly owing to the suppression of many native forms through the browsing of cattle, the hardier plants taking the place of the more delicate. The following are adverted to, viz., *Sonchus oleraceus*, *S. asper*, *Hypochoeris glabra*, and *Geranium cicutarium* among herbs; and *Festuca bromoides*, the silver grass, among Gramineæ. *Orobanche cernua* I have only met once, growing by the side of the road, Kilkerran, on decaying vegetable debris and sandy soil. It is a small plant

with pretty large blue flowers, and in its habitus resembles some liliaceous herbs.

In conclusion it must be stated that the geological distribution of the plants has been described as hitherto observed. Future observations may disclose reasons to alter the arrangement in some instances. In this case and after accumulation of further material, I shall feel happy in laying the results before the Society.

Native and Naturalised Plants,

ARDROSSAN, YORKE'S PENINSULA.

Collected by Otto Tepper, F.L.S., Corr. Member. Named and arrangement revised by Baron F. von Mueller, K.C.M.G., F.R.S., &c., Hon. Member.

[Read April 6, 1880.]

I.—NATIVE PLANTS.

DICOTYLEDONS.

Ranunculaceæ.

Clematis microphylla, *De Candolle.* G.
Ranunculus parviflorus, *Linné.* P.

Dilleniaceæ.

Hibbertia stricta, *R. Brown.* T.

Papaveraceæ.

Papaver aculeatum, *Thunberg.* Maitland road. P.

Cruciferæ.

Alyssum linifolium, *Stephen.* Coast.
Erysimum brevipes, *F. M.* Coast.
lasiocarpum, *F. M.* G.
Stenopetalum lineare, *R. Brown.* Coast.
sphærocarpum, *F. M.* Coast.
Capsella elliptica, *Meyer.* Coast.
pilosula, *F. M.* Coast.
Lepidium monoplocoides, *F. M.* G.

Pittosporeæ.

Pittosporum phillyræoides, *De Candolle.* G.
Bursaria spinosa, *Cavanilles.* G.

Billardiera cymosa, *F. M.* P. Y. Valley scrub and Mait. rd.
var. scricophora, *F. M.* Coast. T.
Cheiranthera linearis, *A. Cunningham.* T.

DROSERACEÆ.

Drosera glanduligera, *Lehmann.* T.
Menziesii, *R. Brown.* Coast and T.
Whittakeri, *Planchon.* Kalkabury. P.

POLYGALEÆ.

Comesperma volubile, *Labilladiere.* G.

FRANKENIACEÆ.

Frankenia lævis, *Linné.* Swamps. C.

PHYTOLACCEÆ.

Didymotheca thesioides, *J. Hooker.* Kilkerran. T

CARYOPHYLLEÆ.

Saponaria tubulosa, *F. M.* Coast plain.
Sagina apetala, *Arduino.* P.
Spergularia rubra, *Persoon.* Coast, plain.
var. marginata. Kilkerran, west coast.

PORTULACEÆ.

Claytonia calyptrata, *F. M.* G.
corrigiolacea, *F. M.* Coast.

FICOIDEÆ.

Mesembrianthemum æquilaterale, *Haworth.* T. and P.
australe, *Solander.* G.
Tetragonia implexicoma, *J. Hooker.* Coast.

SALSOLACEÆ.

Rhagodia Billardieri, *R. Brown.* Coast and T.
nutans, *R. Brown.* G.
spinescens, *R. Brown.*
var. deltophylla.
parabolica, *R. Brown.*
Chenopodium nitrariaceum, *F. M.* Coast.
microphyllum, *F. M* P.
carinatum, *R. Brown.* Swamp, Mangrove Point.
Atriplex paludosum, *R. Brown.* Swamp, Mangrove Point.
cinereum, *Poiret.* Coast.
prostratum, *R. Brown.* Ardrossan. Coast.
Enchylæna tomentosa, *R. Brown.* Coast.
Kochia villosa, *Lindley.* Coast.
Salsola Kali, *Linné.*
oppositifolia, *F. M.* Swamp, Mangrove Point.
brevifolia, *R. Brown.* Coast.

Chenolea diacantha, *F. M.* Coast.
enchylænoides, *F. M* Coast.
Salicornia australis, *Forster.* Kilkerran, West Coast.
arbuscula, *R. Brown.* Kilkerran, West Coast.

AMARANTACEÆ.

Ptilotus spathulatus, *Poiret.* Open ground, G.

POLYGONACEÆ.

Rumex Brownii, *Campdera.* Open ground, G.
Muehlenbeckia adpressa, *Meissner.* P.

MALVACEÆ.

Lavatera plebeia, *Sims.* Coast and T.
Plagianthus Berthæ, *F. M.* Maitland road, P.
spicatus, *Bentham.* Muloowurtie, P., burnt soil.
Sida corrugata, *Lindley.* P.
Hibiscus Wrayæ, *Lindley.* Kilkerran, P.

STERCULIACEÆ.

Lasiopetalum discolor, *Hooker.* T.
Behrii, *F. M.* T. and P.
Baueri, *Steetz.* P.

LINEÆ.

Linum marginale, *A. Cunningham.* G.

ZYGOPHYLLEÆ.

Nitraria Schoberi, *Linné.* Coast.
Zygophyllum fruticulosum, *De Candolle.* Coast.
Billardieri, *De Candolle.* Parara Mine, P.
ammophilum, *F. M.* Coast.
glaucescens, *F. M.* Muloowurtie and Ardros. C.
crenatum, *F. M.* Coast and T.

GERANIACEÆ.

Geranium dissectum, *Linné.* G.
Erodium cygnorum, *Nees.* G.
Pelargonium australe, *Willdenow.* G.
var. erodioides, *Hooker.* G.
Oxalis corniculata, *Linné.* G.

RUTACEÆ.

Boronia clavellifolia, *F. M.* G.
Eriostemon lepidotus, *Sprengel.* Maitland road, P.
var. sediflora.
capitatus, *F. M.* Maitland road.
Correa speciosa, *Aiton.* G.
Geijera parviflora, *Lindley.* Coast.

SAPINDACEÆ.

Dodonæa viscosa, *Linné.* T. and P.
bursarifolia, *Behr* and *Mueller.* T and P.
Baueri, *Endlicher.* P.
hexandra, *F. M.* T.
boroniæfolia, *G. Don.* Yorke Valley, P.
humilis, *Endlicher.* Maitland road, P.
stenozyga, *F. M.* Parara Mine, P.
Heterodendron oleæfolium, *Desfont.* Ardrossan, coast.

STACKHOUSIÆ.

Stackhousia linarifolia, *Cunningham.* Coast and T.

URTICEÆ.

Parietaria debilis, *Forster.* Coast and T.

EUPHORBIACEÆ

Euphorbia Drummondi, *Boissier.* Open low ground, G.
Poranthera microphylla, *Brongniart.* Burnt ground, G.
Beyeria opaca, *F. M.* Coast and T.
Adriana quadripartita, *Gaudichaud.* Yorke Valley, P.

RHAMNACEÆ.

Pomaderris obcordata, *Fenzl.* T.
racemosa, *Hooker.* G.
Spyridium leucophractum, *F. M.* T. and P.
eriocephalum, *Fenzl.* T. and P.
Cryptandra amara, *Smith.* T.
tomentosa, *Lindley.* T.

LEGUMINOSÆ.

Daviesia genistifolia, *A. Cunn.* Maitland rd., lowest ground, P.
Pultenæa tenuifolia, *R. Brown.* Yorke Valley, P.
Eutaxia empetrifolia, *Schlechtendal.* G.
var. diffusa. Yorke Valley, P.
Templetonia sulcata, *Bentham.* Maitland road, P.
Swainsona phacoides, *Bentham.* Coast.
laxa, *R. Brown.* Rogue's Gully, Muloowurtie, P.
Glycine clandestina, *Wendland.* G.
Kennedya prostrata, *R. Brown.* Coast and T.
var. albiflora. Maitland, P.
monophylla, *Ventenat.* T. and P.
Lotus australis, *Seringe.* Coast.
var., Behriana. P hills.
Indigofera australis, *Willd.* Rogue's Gully, Muloowurtie, P.
Cassia eremophila, *A. Cunningham.* T. and P.
heteroloba, *Lindley.* T.

Acacia spinescens, *Bentham.* T. and P.
hakeoides, *Cunningham.* Ardrossan. C. and T.
rigens, *A. Cunningham.* Maitland-road, P.
sclerophylla, *Lindley.* G.
Osswaldi, *F. M.* Coast.
notabilis, *F. M.* Yorke Valley, P.
salicina, *Lindley.* G.
longifolia, *Willdenow.* T. and P.
var. Sophoræ, *R. Brown.*
brachybotrya, *Bentham.* Ardrossan, P.
microcarpa, *F. M.* Yorke Valley, swamp.

ROSACEÆ.

Acæna ovina, *A. Cunningham.* Coast.

CRASSULACEÆ.

Tillæa macrantha, *J. Hooker.* Open ground, G.
purpurascens, *J. Hooker.* Open ground, G.
verticillaris, *De Candolle.* Kalkabury, P.

HALORAGEÆ.

Haloragis tetragyna, *R. Brown.* Yorke Valley, P.
ceratophylla, *Endlicher.* Maitland road, P.

LAURINEÆ.

Cassytha melantha, *R. Brown.* G.
pubescens, *R. Brown.* G.
glabella, *R. Brown.* G.

MYRTACEÆ.

Calycothrix tetragona, *Labillardiere.* T.
Bæckia crassifolia, *Lindley.* T. and P.
Callistemon coccineus, *F. M.* Yorke Valley, P.
Melaleuca acuminata, *F. M.* G.
parviflora, *Lindley.* T.
uncinata, *R. Brown.* P.
ericifolia, *Smith.* Coast.
var. pustulata, *J. Hooker.*
Eucalyptus gracilis, *F. M.* G.
uncinata, *Turczaninow.* P.
oleosa, *F. M.* G.
odorata, *Behr.* P.
incrassata, *Labill.* Yorke Valley, clay-pans.

UMBELLIFERÆ.

Hydrocotyle callicarpa, *Bunge.* P., sandy ridge.
capillaris, *F. M.* P., " "
Didiscus eriocarpus, *F. M.* P., " "
cyanopetalus, *F. M.* P., " "

Apium prostratum, *Labillardiere*. Coast.
Daucus brachiatus, *Sieber*. G.

THYMELEÆ.

Pimelea glauca, *R. Brown*. G.
serpyllifolia, *R. Brown*. Coast and T.
curviflora, *R. Brown*. Coast and T.
var. micrantha. T. and P.
phylicoides, *Meissner*. G.
octophylla, *R. Brown*. Kalkabury, P.

PROTEACEÆ.

Grevillea ilicifolia, *R. Brown*. T. and P.
Huegelii, *Meissner*. Coast and T.
Hakea rugosa, *R. Brown*. Coast and T.
flexilis, *F. M.* P.

LORANTHACEÆ.

Loranthus melaleucæ, *Lehm*. On Melaleuca ericifolia. G.
linophyllus, *Fenzl*. Muloowurtie, P.
exocarpi, *Behr*. Yorke Valley, P.

SANTALACEÆ.

Santalum acuminatum, *De Candolle*. G.
persicarium, *F. M.* T. and P.
Choretrum glomeratum. *R. Brown*. Yorke Valley, P.
chrysanthum, *F. M.* Yorke Valley, P.
Exocarpus cupressiformis, *Labill*. Yorke Valley, P.
spartea, *R. Brown*. T. and P.
aphylla, *R. Brown*. G. Coast mainly and P.

RUBIACEÆ.

Opercularia varia, *J. Hooker*. G.
Asperula oligantha, *F. M.* G.
Galium Gaudichaudi, *De Candolle*. G.
australe. *De Cand*. Muloowurtie, coast.

COMPOSITÆ.

Aster pannosus, *F. M.* T. and P.
ramulosus, *Labillardiere*. T.
lepidophyllus, *Persoon*. G.
microphyllus, *Labill*. Yorke Valley.
Muelleri, *Sonder*. Coast and T.
teretifolius, *Sonder*.
picridifolius, *F. M.* T. and P.
axillaris, *F. M.* Coast
exul, *Lindley*. P., on burnt ground.
Huegelii, *F. M.* T. and P.
glutescens, *F. M.* T.

Aster decurrens, *De Candolle*. Muloowurtie, coast, T.
subspicatus, *F. M.* Yorke Valley, P.
Vittadinia australis, *A. Richard* (four varieties). G.
Minuria leptophylla, *De Candolle*. G.
Cunninghami, *Bentham*. Coast.
suædifolia, *F. M.* Kilkerran, sea-beach.
Calotis hispidula, *F. M.* Coast.
lappulacea, *Bentham*. Coast.
Lagenophora Billardieri, *Cassini*. P.
var. Huegeli.
Brachycome pachyptera, *Turcz.* Coast.
ciliaris, *Lessing*. Coast, T.
collina, *Bentham*. T. and P.
tenella, *Turczaninow*. Coast.
Elachanthus pusillus, *F. M.* Coast.
Myriocephalus rhizocephalus, *Bentham*. Kalkabury.
Calocephalus citreus, *Lessing*. Coast.
Brownii, *F. M.* Kilkerran, western coast.
Angianthus strictus, *Bentham*. T. and P.
tomentosus, *Wendland*. Coast.
Isoetopsis graminifolia, *Turcz.* Coast.
Gnephosis skirrophora, *Bentham*. Burnt ground, G.
Gnaphalodes uliginosum, *A. Gray*. G.
Craspedia Richea, *Cassini*. Coast and T.
Cassinia lævis, *R. Brown*. T. and P.
arcuata, *R. Brown*. Ardrossan, T. and C.
aculeata, *R. Brown*. Muloowurtie, coast.
Humea cassiniacea, *F. M.* Maitland road, P.
Toxanthus perpusillus, *Turcz.* G.
Rutidosis Pumilo, *Bentham*. Coast.
Millotia tenuifolia, *Cassini*. G.
Athrixia tenella, *Bentham*. Coast.
Podotheca angustifolia, *Cassini*. Coast and roadsides, G.
Podolepis acuminata, *R. Brown*. Coast and T.
canescens, *A. Cunningham*. T. and P.
rugata, *Labillardiere*. P.
Lessoni, *Bentham*. Coast.
Leptorrhynchus pulchellus, *F. M.* G. open ground.
squamatus, *Lessing*. Coast and T.
medius, *Cunningham*. P.
elongatus, *De Candolle*. T. and P.
Waitzia, *Sonder*. P.
Helichrysum Baxteri, *A. Cunningham*. P.
lucidum, *Haeckel*. Maitland road. P.
leucopsidium, *De Candolle*. G.
retusum, *F. M.* T. and P.
apiculatum, *De Candolle*. G.

Helichrysum semipapposum, *De Candolle.* G.
Helipterum floribundum, *De Candolle.* P.
var. Stuartiana, *Sonder* and *Mueller.*
hyalsopermum, *F. M.* Coast.
corymbiflorum, *Schlechtendal.* T. and P.
pygmæum, *F. M.* Coast.
exiguum, *F. M.* Coast.
dimorpholepis, *Bentham.* T. and P. (hills.)
heteranthum, *Turcz.* Coast.
Gnaphalium Japonicum, *Thumberg.* G. on open ground.
indutum, *Hooker.* G. on open ground.
Stuartiana Muelleri, *Sonder.* P. burnt ground.
Erechthites quadridentata, *De Candolle.* G.
hispidula, *De Candolle.* Yorke Valley, swamp.
picridioides, *Turcz.* Coast and T.
Senecio lautus, *Forster.* Coast.
brachyglossus, *F. M.* G.
Cunninghami, *De Cand.* Coast.
Cymbonotus Lawsonianus, *Gaudichaud.* Coast and P. (G.)
Microseris Forsteri, *J. Hooker.* Coast.

STYLIDIEÆ.

Leeuwenhœkia dubia, *Sonder.* Coast.

GOODENOVIEÆ.

Velleia paradoxa, *R. Brown.* G. open ground.
Goodenia ovata, *Smith.* T. and P.
geniculata, *R. Brown.* G.
albiflora, *Schlechtendal,* Kalkabury. P.
cycloptera, *R. Brown.* Coast.
pinnatifida, *Schlechtendal.* Coast and P.
Scævola spinescens, *R. Brown.* G.
crassifolia, *Labill.* Kilkerran and Muloowurtie, coast.
Dampiera rosmarinifolia, *Schlechtendal.* G.

CAMPANULACEÆ.

Wahlenbergia gracilis, *A. De Candolle.* G.
var. quadrifida. Maitland road, P.
Lobelia microsperma, *F. M.* Ardrossan, G.

EPACRIDEÆ.

Styphelia ovalifolia, *R. Brown.* T.
cordifolia, *F. M.* P.
humifusa, *Labillardiere.* T. and P.
patula, *R. Brown.* Coast and T.

PRIMULACEÆ.

Samolus repens, *Persoon.* Salt Marsh, Mangrove Point.

APOCYNEÆ.

Alyxia buxifolia, *R. Brown*. Coast.

LOGANIACEÆ.

Logania ovata, *R. Brown*. P.
linifolia, *Schlechtendal*. P.

GENTIANEÆ.

Sebæa ovata, *R. Brown*. Coast.
Erythræa australis, *R. Brown*. G.

PLANTAGINEÆ.

Plantago varia, *R. Brown*. G.

BORAGINEÆ.

Halgania lavandulacea, *Endlicher*. Maitland road, P.
cyanea, *Lindley*. Yorke Valley, P.
Myosotis australis, *R. Brown*. Yorke Valley, T. and P.
Cynoglossum suaveolens, *R. Brown*. Yorke Valley, T. and P.
Eritrichium australasicum, *A. De Candolle*. Coast.
Echinospermum concavum, *F. M.* Coast.

CONVOLVULACEÆ.

Convulvulus erubescens, *Sims*. Coast and T.
Wilsonia rotundifolia, *Hooker*. Yorke Valley, swamp.

SOLANACEÆ.

Lycium australe, *F. M.* Coast.
Solanum simile, *F. M.* T. and P.
fasciculatum, *F. M.* T. and coast; burnt ground
Nicotiana suaveolens, *Lehmann*. Coast and P. (G.)

SCROPHULARINÆ.

Veronica calycina, *R. Brown*. Yorke Valley, P.
Euphrasia Brownii, *F. M.* P.

MYOPORINÆ.

Myoporum parvifolium, *R. Brown*. Coast.
deserti, *A. Cunningham*. Maitland road, P.
viscosum, *R. Brown* P.
insulare, *R. Brown*. Coast,
platycarpum, *R. Brown*. P.
Eremophila longifolia, *F. M.* Coast.
Brownii, *F. M.* Coast and T.
" *var.* tomentosa. Kalkabury, P.
Behriana, *F. M.*

VERBENACEÆ.

Avicennia officinalis, *Linné*. Swamp, Mangrove Point.

LABIATÆ.

Mentha saturejoides, *R. Brown.* Yorke Valley, T. and P.
Prostanthera coccinea, *F. M.* T. and P.
Westringia rigida, *R. Brown.* G.
Teucrium sessiliflorum, *Bentham.* Coast and T.
racemosum, *R. Brown.* P.

CASUARINEÆ.

Casuarina distyla, *Ventenat.* P.
quadrivalvis, *Labillard.* Coast and P. (G.)

CONIFERÆ.

Frenela verrucosa, *Mirbel.* T. and P.

MONOCOTYLEDONS.

HYDROCHARIDEÆ.

Halophila ovalis, *Gaudichaud.* C. submarine.

ORCHIDEÆ.

Thelymitra longifolia, *Forster.* G.
antennifera, *J. Hooker.* P.
Diuris palustris, *Lindley.* Coast and T.
pedunculata, *R. Brown.* Coast and T.
Prasophyllum patens, *R. Brown.* G.
Tepperi, *F. M. (spec. nov.).* T. and P.
Microtis porrifolia, *R. Brown.* Coast and T.
Pterostylis reflexa, *R. Brown.* T.
barbata, *Lindley.* Yorke Valley, P.
mutica, *R. Brown.* T.
longifolia, *R. Brown.* Coast and T.
rufa, *R. Brown.*
var. Mitchelli, *Lindley.* G., open g.
Eriochilus autumnalis, *R. Brown.*
Cyrtostylis reniformis, *R. Brown.* Yorke Valley, P.
Caladenia Patersoni, *R. Brown.* G., open ground.
latifolia, *R. Brown.* Yorke Valley, P.
deformis, *R. Brown.* Coast and T.
Glossodia major, *R. Brown.* P.

AMARYLLIDEÆ.

Hypoxis glabella, *R. Brown.* G. open ground.
Calostemma purpureum, *R. Brown.*

LILIACEÆ.

Thysanotus Patersoni, *R. Brown* Coast and T.
exasperatus, *F. M.* Yorke Valley, P.
Arthropodium minus, *R. Brown.* G.
strictum, *R. Brown.* Coast.

Bulbine bulbosa, *Haworth.* Coast and T.
semibarbata, *Haworth.* Yorke Valley, P.
Wurmbsea diotia, *F. M.* G.
Burchardia umbellata, *R. Brown.*
Dianella revoluta, *R. Brown.* G.

XEROTIDEÆ.

Xerotes glauca, *R. Brown.* G.
leucocephala, *R. Brown.* Tiddy Widdy, coast.
effusa, *Lindley.* Coast and T.
dura, *F. M.* Coast.

JUNCACEÆ

Juncus pallidus, *R. Brown.* Yorke Valley.
bufonius, *Linné.* Yorke Valley.

NAJADEÆ.

Triglochin centrocarpa, *Hooker.* Coast.
Cymodocea antarctica, *Endlicher.* C. submarine.
Zostera nana, *Mertens.* C. submarine.
Posidona australis, *J. Hooker.* C. submarine

CYPERACEÆ.

Scirpus cartilagineus, *Sprengel.* G., prefers burnt ground.
nodosus, *Rottboell.* Sand dunes, coast.
Cladium lanigerum, *R. Brown.* G.
deustum, *R. Brown.* Coast, Muloowurtie, and P.
Lepidosperma gladiatum, *Labillardiere.* Kilkerran, coast
Chorisandra enodis, *Nees.* Yorke Valley, swamp.

GRAMINEÆ.

Spinifex hirsutus, *Labillardiere.* Coast, sandy beach.
Anthisteria ciliata, *Linné.* T. and P.
Aristida Behriana, *F. M.* Yorke Valley.
Stipa semibarbata, *R. Brown.* T. and P., burnt ground.
elegantissima, *Labillardiere.* Coast and T.
scabra, *Lindley.* G.
crinita, *Gaudichaud.* G.
aristiglumis, *F. M.* Coast and T.
Dichelachne crinita, *J. Hooker.* T.
Agrostis Solandri, *F. M.* G.
Danthonia penicillata, *F. M.* G.
Poa cæspitosa, *Forster.* G.
lepida, *F. M.* Coast.
Festuca irritans, *F. M.* (Porcupine grass). Kilkerran, T.
Agropyrum scabrum, *Beauvois.* G.
Distichlis maritima, *Rafinesque.* Coast, beach.
Bromus arenarius, *Labillardiere.* G.

Neurachne alopecuroides, *R. Brown.* T. and P.
Amphipogon strictus, *R. Brown.* Coast and T.
Lepturus incurvatus, *Trinius.* G.

ACOTYLEDONS.

Filices.

Ophioglossum vulgatum, *Linné.* Coast.
Cheilanthes tennifolia, *Swartz.* G.
Grammitis rutifolia, *R. Brown.* P.

II.—NATURALISED PLANTS.

Capsella bursa-pastoris, *Moench.* Cruciferæ.
Lepidium ruderale, *Linné.* "
Senebiera didyma, *Persoon.* "
Silene gallica, *Linné.* Caryophylleæ.
Cerastium vulgatum, *Linné.* "
Stellaria media, *Villars.* "
Polygonum aviculare, *Linné.* Polygonaceæ.
Malva rotundifolia, *Linné.* Malvaceæ.
Erodium cicutarium, *L'Heretier.* Geraniaecæ.
Medicago denticulata, Leguminosæ.
Melilotus parviflora, *Des.* "
Urtica urens, *L.* Urticeæ.
Cucumis myriocarpa, *Naudin.* Cucurbitaceæ.
Erigeron linifolius, *Willdenow.* Compositæ.
Anthemis Cotula, *Linné.* "
Gnaphalium luteo-album, *Linné.* "
Hypochœris glabra, *Linné.* "
Picris hieracioides, *Linné.* "
Sonchus oleraceus, *Linné.* "
var. asper, *Linné.* "
Centaurea melitensis, *L.* "
Silybum Marianum, *Gaertner.* "
Xanthium spinosum, *L.* "
Cryptostemma calandulaceum, *R. Brown.* Compositæ.
Anagallis arvensis, *var.* cœrula, *L.* Primulaceæ.
Plantago coronopus, *L.* Plantagineæ.
Lithospermum arvense, *L.* Boragineæ.
Solanum nigrum, *L.* Solanaceæ.
Orobanche cernua, *Loeffling.* Orobanchaceæ.
Chenopodium murale, *L.* Salsolaceæ.
Poa annua, *L.* Gramineæ.
rigida, *L.* "
Festuca bromoides, *L.* "
Kœleria phleoides, *Persoon,* "
Hordeum murinum, *L.* "

A CENSUS OF THE INDIGENOUS FLOWERING PLANTS AND FERNS OF EXTRA-TROPICAL SOUTH AUSTRALIA.

By Professor Ralph Tate, Assoc. Lin. Soc., F.G.S., &c., President.

[Read February 3, 1880.]

Introductory and Explanatory Remarks.—In 1875 there appeared Dr. Schomburgk's "Flora of South Australia," in which is included a catalogue of the flowering plants and ferns of South Australia, mostly compiled from the "Flora Australiensis," vols. 1 to 6. Since then vol. 7 of that work has been published, and numerous additions to the flora of this province have been made by Messrs. Giles, Tietkins, Young, Tepper, Kempe, Mrs. Richards, and others. These accessions, as well as the necessary corrections to Dr. Schomburgk's list, render a revised census much to be desired. Despite the imperfections of my list, yet I believe it will be exceedingly useful as furnishing a good basis for further additions. It is one to be improved upon, and some years hence, when the inland vegetation will have become exhaustively known and the geographical range of the larger number of our indigenous plants better defined, a new edition will be required.

The present census is compiled from the "Flora Australiensis" by Mr. Bentham, and from the "Fragmenta Phytographiæ" and other works, by Baron F. von Mueller, and from manuscript notes kindly communicated by the latter gentleman. It contains the names of all indigenous flowering plants and ferns and their immediate allies authentically known to occur in the extra-tropical part of this colony. The undoubted alien species are omitted, and may at some future time form a supplementary list to be published under the auspices of this Society.

The list has been revised by Baron F. von Mueller, and the ordinal arrangement and nomenclature are for the most part in accord with that gentleman's matured researches. As the sequence of the orders is materially different from that followed

in the "Flora Australiensis," I have affixed to each ordinal name the number of the volume of that work dealing with that particular order of plants. And following the name of the species is a reference to the page of the "Flora Australiensis" on which its diagnosis will be found. The references to species not contained in the "Flora Australiensis" are to Baron Mueller's "Fragmenta Phytographiæ," thus:—*Menkea sphærocarpa*, F.M.; Frag. VIII., 223, is described on page 223 of volume VIII. of that work, the authority for the name being Ferdinand Mueller.

To give some idea of the distribution of the constituents of the flora of extra-tropical South Australia, that part of the province is divided into the following regions and districts:—

Region C, or the Central Australian Region, which embraces the country north of a line from the Head of the Great Australian Bight following eastward the line referred to in the 11th Schedule of Crown Lands Act of 1877, extending southward so as to include Lake Gilles, and sweeping round the east side of Lake Torrens, thence to the west side of Lake Frome, and southward to the latitude of Menindie (about 32 degrees).

This region probably admits of division into (*a*) Desert and (*b*) Central Australian; the latter division embracing the elevated country of the Musgrave, MacDonnell's and other ranges, which extend in a general east and west direction in the north-west central parts of the colony. Constituting a part of the same region, by its geological and botanical features, is the narrow strip of hill country traversed by the transcontinental telegraph line between the head of Lake Torrens and the Tropic of Capricorn.

By such division the desert region embraces the vast Tertiary plains and deserts; whilst the Central Australian region is comprised of more elevated land of Palæozoic age.

Though the Central Australian subregion verges on the tropics, yet its flora is of the Desert type, somewhat modified by the presence of a few families and genera which herein reach their southern limits.

Region C is characterised by the large proportion of Crucifers, Zygophylleæ, Malvaceæ, Sterculiaceæ, Euphorbiaceæ, Amarantaceæ, Chenopodiaceæ, Portulaceæ, Ficoideæ, Goodenovieæ, Solanaceæ, Verbenaceæ, Myoporineæ, and Grasses. The only representatives in South Australia proper of Capparids, Elatineæ, Cycads, and Palms are here met with. The following important orders, so characteristic of Region S, or the South Australian region, are either absent or poorly represented:—Pittosporeæ, Droseraceæ, Caryophyllaceæ, Rhamnaceæ, Epacrideæ, Orchidaceæ, Liliaceæ, and Juncaceæ.

Region M, or the Murray Desert.—This region is the southerly extension of the eastern section of the Central Australian Region. It may be defined as the whole of the country (exclusive of Region E) to the east of the Adelaide chain, and its N.E. extension towards the Barrier Ranges. Its physical features are very pronounced, for whilst the region to the west is occupied by elevated ground of Palæozoic age, the Murray Desert is a plain constituted of Tertiary rocks. Like that of the Central Australian Region, the rainfall is absolutely small.

The geophilous florula of this region, excepting the exclusively maritime species, is of the same type as that of Region C, though it possesses fewer restricted species. The fluviatile and paludinal species of the River Murray, which receives little or no drainage in its passage through this region, assimilate the vegetation of the Murray Region to that of Region S *c*.

Region E, or that of the South-East, being the extreme south-east corner of this colony, centred about the volcanic area of Mount Gambier. To the Rev. J. E. Tenison Woods, F.L.S., &c., my obligations are due for the use of a MS. list of plants observed by him in the South-East district of this colony between the years 1857 and 1867. It contains the names of over 200 species hitherto unrecorded for that part of South Australia. Baron F. von Mueller is the authority for nearly all of them. Its vegetation has the general characteristic of that of Region S *c*, and is mainly distinguished from it by the possession of species which here reach their western limit. The sole representative in South Australia of the order Caprifoliaceæ occurs in this region. The northern boundary line of the region must be somewhat south of the railroad connecting Kingston and Narracoorte.

Region S, or the South Australian Region, embraces the rest of the province. It may be divided into the following districts:—

a. The country to the north of the head of St. Vincent's Gulf.
b. Eyre's Peninsula, and westward to the head of the Great Australian Bight, south of the south-western boundary of Region C.
c. The country south of District *a*, east of St. Vincent's Gulf, and on the east limited by the Murray Desert.
d. Yorke's Peninsula.
k. Kangaroo Island

The prominent botanical features of Region S have been referred to under Region C.

Note.—The capital and small letters in the columns indicating the distribution of a species are correspondingly those of the regions and districts used in the foregoing paragraphs.

The letters enclosed in brackets indicate that the species are of modern introduction into the districts denoted by such letters.

The following table represents the number of species inhabiting each region, and the number of species restricted to each:—

	C	M	E	S	*a*	*b*	*c*	*d*	*k*
Total number of species	688	550	455	959	267	382	643	381	154
Number of restricted species ..	355	81	124	272	25	31	96	9	13
and marked varieties ..	3	3	2	4	—	1	3	2	4

The high percentage of restricted species inhabiting each region seems to justify that botanical division of the province which has herein been established. Nevertheless, the above figures may not represent the whole truth; thus the small number of species catalogued for the Regions M and E includes, perhaps, only the less common forms; and if the real numerical strength of each were known, doubtlessly the total of peculiar species in the adjoining regions might be much reduced, though the number of restricted species in Regions M and E would not be materially altered. The same remarks will also apply to the districts of Region S. It should be remembered that the boundaries of the regions and districts are not rigidly defined, as such can only be laid down after an exhaustive inquiry into the climatological, botanical, and geological features of each division And at the same time, that in a first attempt of the kind, it has not always been easy to find the geographic columns for each species, more particularly because one region must overlap or pass gradually into another.

Dr. Schomburgk's list of extra-tropical plants gives the names of 1,214 species; but the number is reducible to 1,074 by exclusion of certain introduced species and others not known to belong to extra-tropical South Australia, and by suppression of names not of specific value. Some species have wrongly assigned to them a South Australian habitus in the Flora Australiensis, by reason of certain Victorian localities being quoted for this colony. Baron von Mueller has considerably reduced the number of species recognised by Mr. Bentham, but whether the results obtained are in accordance with or opposed to the teachings of the living plants is a question that each botanist must endeavour to answer for himself, as the plan of the present work does not admit of a discussion of the many questions raised by them.

The result of the present compilation, so far as numbers are concerned, is as follows :—

	Orders.	Genera.	Species.
1. Dicotyledoneæ	80	360	1,230
2. Monocotyledoneæ ...	15	112	321
3. Acotyledoneæ	3	18	31
	98	490	1,582

The most prominent orders by the number of their species are—

	No. of Species.	No. of Genera.	Ratio of Species to Genera as 1.
1. Compositæ ...	200	53	3·7
2. Leguminosæ ...	165	34	4·8
3. Gramineæ ...	111	40	3·7
4. Chenopodiaceæ	72	12	6
5. Cyperaceæ ...	69	11	6·3
6. Myrtaceæ ...	65	11	5·9
In a subordinate rank—			
7. Orchidaceæ ...	47	17	2·7
8. Goodenovieæ ...	40	8	5
9. Myoporineæ ...	39	2	19·5
10. Malvaceæ ...	34	8	4·2
11. Cruciferæ ...	33	10	3·3
12. Proteaceæ ...	32	8	4

The figures in the third column represent in an inverse sequence the prominence of the natural orders in respect to morphological variety; Orchidaceæ heading the list and Myoporineæ closing it.

DICOTYLEDONEÆ.							
RANUNCULACEÆ (Fl. Aust., vol. I.)							
Clematis aristata, *R. Brown*; 6			E				
microphylla, *De Cand.*; 7			E	*a*	*b*	*c*	*d*
Myosurus minimus, *Linné*; 8			E				
Ranunculus aquatilis, *Linné*; 10		M	E			*c*	
lappaceus, *Smith*; 12			E			*c*	
rivularis, *Banks*; 13		M	E			*c*	
parviflorus, *Linné*; 14	C					*c*	*d*
DILLENIACEÆ (Fl. Aust., vol. I.)							
Hibbertia densiflora, *F. M.*; 26			E			*c*	
stricta, *R. Brown*; 27		M		*a*	*b*	*c*	*d*
Billardieri, *F. M.*; 28			E	*a*			

Hibbertia acicularis, *F. M.*; 29			E					
fasciculata, *R. Brown*; 33			E	*a*	*b*	*c*		
virgata, *R. Brown*; 34	C	M						
glaberrima, *F. M.*; 39	C							
LAURINEÆ (Fl. Aust., vol. V.)								
Cassytha glabella, *R. Brown*; 309		M	E		*b*		*d*	*k*
pubescens, *R. Brown*; 310		M	E		*b*	*c*	*d*	
melantha, *R. Brown*; 311	C	M		*a*	*b*	*c*	*d*	
PAPAVERACEÆ (Fl. Aust., vol. I.)								
Papaver aculeatum, *Thunb.*; 63		M		*a*		*c*	*d*	
CRUCIFERÆ (Fl. Aust., vol. I.)								
Nasturtium terrestre, *R. Brown*; 65		M	E			*c*		
Cardamine laciniata, *F. M.*; 69		M	E			*c*	*d*	
hirsuta, *Linné*; 70			E	*a*		*c*		
eustylis, *F. M.*; 71		M						
Alyssum mininum, *Pallas*; 71		M		*a*	*b*		*d*	
Sisymbrium filifolium, *F. M.*; 74				*a*				
trisectum, *F. M.*; 74	C	M		*a*	*b*			
nasturtioides, *F. M.*; 74		M		*a*				
cardaminoides, *F. M.*; 75		M	E			*c*		
Erysimum curvipes, *F. M.*; 75	C	M		*a*			*d*	
brevipes, *F. M.*, 75	C	M		*a*			*d*	
lasiocarpum, *F. M.*; 76	C	M						
Blennodia, *F. M.*; 76	C							
Richardsi, *F. M.*; Frag. x., 105	C							
Stenopetalum velutinum, *F. M.*; 78	C	M						
lineare, *R. Brown*; 78		M			*b*	*c*	*d*	
sphærocarpum, *F. M.*; 78		M		*a*	*b*	*c*	*d*	
nutans, *F. M.*; 79	C							
Menkea sphærocarpa, *F. M.*; Frag. viii., 223	C							
australis, *Lehmann*; 80		M						
Capsella elliptica, *Meyer*; 81		M	E		*b*	*c*	*d*	
pilosula, *F. M.*; 82	C	M					*d*	
humistrata, *F. M.*; Frag. xi., 25		M						
cochlearina, *F. M.*; 88				*a*	*b*			
Drummondi, *F. M.*; 88	C							
Geococcus pusillus, *Drummond*; 80		M			*b*		*d*	
Lepidium strongylophyllum, *F. M.*; 84	C							
leptopetalum, *F. M.*; 84		M						
phlebopetalum, *F. M.*; 85	C	M		*a*				
monoplocoides, *F. M.*; 85		M					*d*	
papillosum, *F. M.*; 86	C	M		*a*				
foliosum, *Desv.*; 86			E					*k*
ruderale, *Linné*; 86	C	M						

CAPPARIDEÆ (Fl. Aust., vol. I.)								
Capparis Mitchelli, *Smith*; 96	c							
Cleome viscosa, *Linné*; 90	c							
VIOLACEÆ (Fl. Aust., vol. I.)								
Viola betonicæfolia, *Smith*; 99			E			*c*		
hederacea, *Labill.*; 99			E			*c*		*k*
Hybanthus floribundus, *F. M.*; 102	c	M	E	*a*		*c*		
aurantiacus, *F. M.*; 102	c							
DROSERACEÆ (Fl. Aust., vol. II.)								
Drosera Indica, *Linné*; 456	c							
glanduligera, *Lehm.*; 457			E			*c*	*d*	
pygmæa, *De Cand.*; 457			E			*c*		
Burmanni, *Vahl.*; 459	c							
spathulata, *Labill.*; 459			E					
binata, *Labill.*; 461			E			*c*		
Whittakeri, *Planchon*; 462			E			*c*	*d*	
auriculata, *Backh.*; 465						*c*		
peltata, *Smith*; 465			E					
Menziesi, *R. Brown*; 468			E	*a*		*c*	*d*	
PITTOSPOREÆ (Fl. Aust., vol. I.)								
Pittosporum phillyræoides, *De Cand.*; 112	c	M	E	*a*	*b*	*c*	*d*	*k*
Bursaria spinosa, *Cav.*; 115		M	E		*b*	*c*	*d*	
Marianthus bignoniaceus, *F. M.*; 118						*c*		
Billardiera longiflora, *Labill.*; 123			E					
scandens, *Smith*; 123			E					
cymosa, *F. M.*; 124			E	*a*	*b*	*c*	*d*	*k*
Cheiranthera linearis, *A. Cunn.*; 127				*a*	*b*	*c*	*d*	*k*
volubilis, *Benth.*; 128								*k*
POLYGALEÆ (Fl. Aust., vol. I.)								
Comesperma scoparium, *Steetz*; 143		M						
volubile, *Labill.*; 144			E		*b*		*d*	
sylvestre, *Lindley*; 146	c							
calymega, *Labill.*; 147						*c*		*k*
polygaloides, *F. M.*; 149			E		*b*	*c*		*k*
TREMANDREÆ (Fl. Aust., vol. I.)								
Tetratheca ciliata, *Lindley*; 130			E					
var. ericifolia, *Smith*; 131			E					
pilosa, *Labill.*; 131				*a*		*c*		
STERCULIACEÆ (Fl. Aust., vol. I.)								
Gilesia binifolia, *F. M.*; Frag. ix., 42	c							

Melhania incana, *Heyne*; 234	c						
Waltheria Indica, *Linné*; 236	c						
Commersonia magniflora, *F. M.*; Frag. x., 22	c						
loxophylla, *F. M.*; 240	c						
Seringea nephrosperma, *F. M.*; 246	c						
Hookeriana, *Walp.*; 246	c						
integrifolia, *F. M.*; 247	c						
Thomasia petalocalyx, *F. M.*; 255			E		c		*k*
Lasiopetalum discolor, *Hooker*; 260				*b*		*d*	*k*
Behrii, *F. M.*; 261	c	M	*a*	*b*	*c*	*d*	*k*
Baueri, *Steetz*; 263		M	*a*	*b*	*c*	*d*	*k*
Schulzeni, *F. M.*; 265		E		*b*			*k*
Brachychiton Gregorii, *F. M.*; Frag. iv., 137	c						
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Lavatera plebeia, *Smith*; 185	c	M	*a*	*b*	*c*	*d*	
Malvastrum spicatum, *A. Gray*; 187	c		*a*				
Plagianthus spicatus, *Benth.*; 189		M	E	?		*d*	
glomeratus, *Benth.*; 190	c			*b*		*d*	
microphyllus, *F. M.*; 190		M	E	*b*	*c*		
Berthæ, *F. M.*; Frag. v., 103						*d*	
Sida corrugata, *Lindley*; 192	c	M	*a*	*b*		*d*	
cardiophylla, *F. M.*; Frag. viii., 242	c						
intricata, *F. M.*; 193	c						
virgata, *Hooker*; 194	c						
cryphiopetala, *F. M.*; 194	c						
petrophila, *F. M.*; 194	c		*a*				
calyxhymenia, *Gay*; 194	c						
inclusa, *Bentham*; 197	c						
Howittia trilocularis, *F. M.*; 198	c	M					
Abutilon tubulosum, *A. Cunn.*; 200	c						
leucopetalum, *F. M.*; 200	c						
Mitchelli, *Benth.*; 201			*a*				
macrum, *F. M.*; Frag. ix., 59	c						
otocarpum, *F. M.*; 202	c	M					
Avicennæ, *Gaertn.*; 203	c	M					
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brachysiphonius, *F. M.*; 210	c						
microchlænus, *F. M.*; 211	c						
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Krichauffianus, *F. M.*; 216	c						
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Wrayæ, *Lind.*; 217; Frag. ix., 128	c		*a*	*b*		*d*	
Farragei, *F. M.*; Frag. viii., 241	c						
hakeifolius, *Giord.*; 220	c		*a*	*b*			

Gossypium Sturtii, *F. M.*; 222	c			*a*				
australe, *F. M.*; 220	c							
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Euphorbia australis, *Boiss.*; 48	c	m						
Drummondi, *Boiss.*; 49	c	m		*a*		*c*	*d*	
Wheeleri, *Baill.*; 49	c							
cremophila, *A. Cunn.*; 52	c	m		*a*				
Poranthera ericoides, *Klotzsch*; 55			e			*c*		
microphylla, *Brong.*; 56			e	*a*	*b*	*c*	*d*	
Pseudanthus micranthus, *Benth.*; 59						*c*		
Beyeria viscosa, *Miq.*, *var.* opaca; 65	c	m	e		*b*	*c*	*d*	*k*
var. uncinata; 65		m						
Ricinocarpus pinifolius, *Desf.*; 70			e					
Bertya Cunninghami, *Planchon*; 75	c							
oleifolia, *Planchon*; 76		m			*b*	*c*		
rotundifolia, *F. M.*; 77								*k*
Monotaxis luteiflora, *F. M.*; Frag. x., 51	c							
Amperea spartioides, *Brong.*; 84			e					
Phyllanthus calycinus, *Labill.*; 105		m		*a*	*b*			
Fuernrohri, *F. M.*; 107	c	m						
trachspermus, *F. M.*; 108		m						
lacunarius, *F. M.*; 108		m						
thymoides, *Sieb.*; 109		m						
Gunnii, *Hooker*; 110				*a*				
Adriana tomentosa, *Sand.*; 134	c	m						
quadripartita, *Gaud.*; 135			e		*b*	*c*	*d*	*k*
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Ficus platypoda, *A. Cunn.*; 169	c							
orbicularis, *A. Cunn.*; 175	c							
Parietaria debilis, *G. Forst.*; 188	c	m	e		*b*	*c*	*d*	*k*
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Diplopeltis Stuarti, *F. M.*; 456	c							
Atalaya hemiglauca, *F. M.*; 463	c							
Heterodendron oleifolium, *F. M.*; 469	c	m		*a*			*d*	
Dodonæa petiolaris, *F. M.*; 475	c							
viscosa, *Linné*; 475	c	m	e			*c*	*d*	
var. attenuata; 477		m		*a*				*k*
procumbens, *F. M.*; 478			e					
lobulata, *F. M.*; 479	c			*a*	*b*			
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Baueri, *Endlicher*; 482		m	e	*a*	*b*		*d*	
hexandra, *F. M.*; 483					*b*		*d*	
humilis, *Endlicher*; 485				*a*	*b*	*c*	*d*	
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Pelargonium australe, *Willd.*; 298			E			*c*	*d*	
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Zygophyllum apiculatum, *F. M.*; 292	C	M		*a*				
glaucescens, *F. M.*; 293	C	M		*a*	*b*	*c*	*d*	
crenatum, *F. M.*; 293	C	M		*a*			*d*	
iodocarpum, *F. M.*; 293	C	M		*a*				
prismatothecum, *F. M.*; 293				*a*				
Billardieri, *De Cand.*; 293	C	M	E	*a*	*b*	*c*	*d*	*k*
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fruticulosum, *De Cand.*; 294	C	M		*a*	*b*		*d*	
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Nitraria Schoberi, *Linné*; 291	C	M		*a*	*b*	*c*	*d*	*k*
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Zieria veronicea, *F. M.*; 305						*c*		*k*
Boronia Edwardsi, *Benth.*; 312						*c*		
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cærulescens, *F. M.*; 320	C	M	E	*a*	*b*	*c*		
polygalifolia, *Smith*; 320			E			*c*		
filifolia, *F. M.*; 325		M				*c*		*k*
clavellifolia, *F. M.*; 325	C	M			*b*		*d*	
Eriostemon obovalis, *A. Cunn.*; 334		M						
linearis, *A. Cunn.*; 334	C							

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lepidotus, *Spreng.*; 342	c	M		*a*			*d*	
capitatus, *F. M.*; 346	c				*b*		*d*	
Correa æmula, *F. M.*; 353			E			*c*		
alba, *Andr.*; 354			E			*c*		*k*
speciosa, *Ait.*; 354	c		E		*b*		*d*	
decumbens, *F. M.*; 356						*c*		*k*
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Codonocarpus pyramidalis, *F. M.*; 148	c			*a*				
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multiflora, *Hooker*; 159			E			*c*		
Sagina procumbens, *Linné*; 160						*c*		
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crassifolia, *R. Brown*; 154	c							*k*
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var. deltophylla							*d*	
nutans, *R. Brown*; 156	c	M				*c*	*d*	*k*
Chenopodium nitrariaceum, *F. M.*; 158	c	M					*d*	
microphyllum, *F. M.*; 161		M			*b*	*c*	*d*	
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carinatum, *R. Brown*; 162	c	M	E			*c*	*d*	

Chenopodium pumilio, *R. Brown*; 163								*k*
cristatum, *F. M.*; 163	C	M		*a*	*b*			
atriplicinum, *F. M.*; 163	C	M		*a*				
Dysphania plantaginella, *F. M.*; 164	C							
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Atriplex stipitatum, *Benth.*; 168	C	M		*a*				
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nummularium, *Lind.*; 170	C	M						
cinereum, *Poiret*; 171		M	E	*a*	*b*	*c*	*d*	*k*
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angulatum, *Benth.*; 174		M		*a*				
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leptocarpum, *F. M.*; 178		M						
halimoides, *Lind.*; 178	C	M		*a*	*b*			
holocarpum, *F. M.*; 179	C							
spongiosum, *F. M.*; 179	C	M						
Enchylæna tomentosa, *R. Brown*; 181	C	M		*a*	*b*	*c*	*d*	
Chenolea enchylænoides, *F. M.*; 182						*c*	*d*	
Dallachyana, *Benth.*; 191		M						
tricornis, *Benth.*; 191		M						
sclerolænoides, *F. M.*; 192	C	M		*a*				
uniflora, *F. M.*; 194					*b*			
diacantha, *F. M.*; 194	C	M			*b*	*c*	*d*	
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biflora, *F. M.*; 196	C	M			*b*			
paradoxa, *F. M.*; 196		M				*c*		
tricuspis, *F. M.*; 200	C	M			*b*			
bicuspis, *F. M.*; 200	C			*a*				
quinquecuspis, *F. M.*; 199		M						
echinopsila, *F. M.*; 201	C	M						
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Threlkeldia diffusa, *R. Brown*; 197						*c*		
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lobiflora, *F. M.*; 184	C							
lanosa, *Lind.*; 184	C	M						
triptera, *Benth.*; 185	C	M.						

Kochia oppositifolia, *F. M.*; 185		M		*a*	*b*	*c*	*d*
brevifolia, *R. Brown*; 185		M		*a*	*b*	*c*	*d*
pyramidata, *Benth.*; 186		M					
eriantha, *F. M.*; 186	c						
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ciliata, *F. M.*; 188	c						
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tenuis, *Benth.*; 204	c						
australis, *Soland.*; 205	c		E		*b*	*c*	*d*
Suæda maritima, *Dumort.*; 206			E		*b*		*d*
Salsola Kali, *Linné*; 207	c	M	E	*a*	*b*	*c*	*d*
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æquilaterale, *Haw.*; 324	c	M	E	*a*	*b*	*c*	*d*
Tetragonia expansa, *Murray*; 325	c	M		*a*			
implexicoma, *J. Hooker*; 326			E		*b*	*c*	*d*
Aizoon quadrifidum, *F. M.*; 327	c						
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crystallina, *Vahl.*; 330	c						
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Glinus, *A. Rich.*; 333	c	M		*a*			
Spergula, *Linné*; 334		M					
Cerviana, *Ser.*; 334	c	M					
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flexuosus, *Solander*; 264		M				*c*	
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prostratum, *R. Brown*; 268		M					
hydropiper, *Linné*; 269			E				
minus, *Hudson*; 269		M	E			*c*	
lapathifolium, *Linné*; 270		M					
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Mirbelia oxyclada, *F. M.*; 38	c							
Isotropis atropurpurea, *F. M.*; 40	c							
Whecleri, *F. M.*; 40	c							
Gompholobium minus, *Smith*; 45	c	M	E			*c*		*k*
Burtonia polyzyga, *Benth.*; 50	c							
Sphærolobium vimineum, *Smith*; 65		M				*c*		
Viminaria denudata, *Smith*; 68			E			*c*		
Daviesia arthropoda, *F. M.*; Frag. viii., 225	c							
corymbosa, *Smith*; 76				*a*		*c*		
ulicina, *Smith*; 81		M	E	*a*		*c*		
genistifolia, *A. Cunn.*; 82			E	*a*			*d*	
incrassata, *Smith*; 83					*b*			*k*
brevifolia, *Lind.*; 84		M	E			*c*		
pectinata, *Lind.*; 87					*b*			
Aotus villosa, *Smith*; 90		M	E					
Phyllota Sturtii, *Benth.*; 95	c							
pleurandroides, *F. M.*; 96			E		*b*	*c*		*k*
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pedunculata, *Hooker*; 118					*b*	*c*		
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humilis, *Benth.*; 132			E					
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laxiflora, *Benth.*; 133						*c*		
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densifolia, *F. M.*; 136		M			*b*	*c*		
villifera, *Sieb.*; 137					*b*	*c*		
involucrata, *Benth.*; 138						*c*		
prostrata, *Benth.*; 138		M						
canaliculata, *F. M.*; 139						*c*		
tenuifolia, *R. Brown*; 139		M	E		*b*	*c*	*d*	*k*
Eutaxia empetrifolia, *Schlecht.*; 145		M			*b*	*c*	*d*	
Dillwynia hispida, *Lind.*; 147		M	E		*b*	*c*		
ericifolia, *Smith*; 147			E					
floribunda, *Smith*; 149			E			*c*		*k*

Dillwynia cinerascens, *R. Brown*; 151			E					
patula, *F. M.*; 151		M			*b*			
Platylobium triangulare, *R. Brown*; 152			E					
obtusangulum, *Hooker*; 153			E			*c*		*k*
Bossiæa cinerea, *R. Brown*; 160			E					
prostrata, *R. Brown*; 162			E			*c*		
riparia, *A. Cunn.*; 166					*b*			
Walkeri, *F. M.*; 167	c							
Templetonia retusa, *R. Brown*; 169	c			*a*	*b*			
egena, *Benth.*; 170	c	M		*a*	*b*			
sulcata, *Benth.*; 171		M					*d*	
Hovea longifolia, *R. Brown*; 172		M		*a*				
heterophylla, *A. Cunn.*; 172			E					
Goodia lotifolia, *Salisb.*; 177			E	*a*		*c*		
medicaginea, *F. M.*; Frag. i., 10			E			*c*		*k*
Crotalaria Cunninghami, *R. Brown*; 182	c							
dissitiflora, *Benth.*; 184	c							
Trigonella suavissima, *Lind.*; 187	c							
Lotus australis, *Andr.*; 188	c		E	*a*		*c*	*d*	*k*
var. Behrianus		M				*c*	*d*	
Psoralea balsamica, *F. M.*; 191	c							
eriantha, *Benth.*; 192	c	M	E					
patens, *Lind.*; 192	c	M	E	*a*	*b*	*c*		
leucantha, *F. M.*; 193	c							
adscendens, *F. M.*; 193			E			*c*		
Indigofera enneaphylla, *Linné*; 196	c							
viscosa, *Lamarck*; 198	c							
hirsuta, *Linné*; 198	c							
monophylla, *De Cand.*; 199	c							
australis, *Willd.*; 199	c		E			*c*	*d*	
brevidens, *Benth.*; 200	c							
coronillæfolia, *A. Cunn.*; 201	c							
Ptychosema anomalum, *F. M.*; Frag. ix., 62	c							
Sesbania aculeata, *Pers.*; 213	c							
Clianthus Dampieri, *A. Cunn.*; 214	c			*a*				
Swainsona Greyana, *Lind.*; 216		M						
coronillæfolia, *Salisb.*; 217	c			*a*				
colutoides, *F. M.*; Frag. x., 6	c							
phacoides, *Benth.*; 217	c	M					*d*	
Burkitti, *F. M.*; 218	c							
Burkei, *F. M.*; 218	c							
oligophylla, *F. M.*; 219	c							
campylantha, *F. M.*; 219	c							
procumbens, *F. M.*; 220			E	*a*	*b*	*c*		
phacifolia, *F. M.*; 221	c			*a*				
lessertiifolia, *De Cand.*; 222		M	E	*a*		*c*		
unifoliolata, *F. M.*; Frg. viii., 226	c							

Swainsona microphylla, *A. Gray*; 223	c	M						
laxa, *R. Brown*; 224		M					*d*	
Glycyrrhiza psoraloides, *Benth.*; 225		M	E					
Lespedeza lanata, *Benth.*; 241	c							
Glycine falcata, *Benth.*; 243	c							
clandestina, *Wendl.*; 243	c		E	*a*	*b*	*c*	*d*	
Latrobeana, *Benth.*; 244			E					
tabacina, *Labill.*; 244				*a*				
sericea, *Benth.*; 245		M						
Kennedya monophylla, *F. M.*; 246				*a*		*c*	*d*	
prostrata, *R. Brown*; 250			E	*a*	*b*	*c*	*d*	
prorepens, *F. M.*; Frag. viii., 225	c							
Erythrina vespertilio, *Benth.*; 253	c							
Cassia Sophera, *Linné*; 283	c							
venusta, *F. M.*; 284	c							
notabilis, *F. M.*; 284	c							
pleurocarpa, *F. M.*; 284	c							
glutinosa, *De Cand.*; 286	c							
circinata, *Benth.*; 286		M						
phyllodinea, *R. Brown*; 287	c		E	*a*	*b*			
eremophila, *A. Cunn.*; 287	c	M		*a*	*b*		*d*	
var. heteroloba		M				*c*	*d*	
artemisioides, *Gaud.*; 288	c			*a*				
Sturtii, *R. Brown*; 288	c	M		*a*	*b*			
desolata, *F. M.*; 289	c							
Petalostylis labicheoides, *R. Brown*; 292	c			*a*				
Bauhinia Leichhardti, *F. M.*; 295	c							
Acacia continua, *Benth.*; 322	c	M		*a*		*c*		
spinescens, *Benth.*; 323		M			*b*	*c*	*d*	
nyssophylla, *F. M.*; 325	c	M						
patens, *F. M.*; 329	c							
tetragonophylla, *F. M.*; 330	c	M		*a*				
rupicola, *F. M.*; 333						*c*		
rhigiophylla, *F. M.*; 333		M						
oxycedrus, *Sieb.*; 334			E					
verticillata, *Willd.*; 334			E	*a*		?		
rigens, *A. Cunn.*; 337					*b*	*c*	*d*	
papyrocarpa, *Benth.*; 338					*b*			
calamifolia, *Sweet*; 339	c	M		*a*	*b*	*c*	*d*	*k*
lycopodifolia, *A. Cunn.*; 342	c							
spondylophylla, *F.M.*; Frag. viii., 243	c							
armata, *R. Brown*; 347		M		*a*	*b*	*c*		*k*
strongylophylla, *F.M.*; Frag. viii., 226	c							
vomeriformis, *A. Cunn.*; 350		M				*c*		
obliqua, *A. Cunn.*; 353		M		*a*		*c*		
acinacea, *Lind.*; 353				*a*	*b*			
lineata, *A. Cunn.*; 353					*b*			

Acacia anceps, *De Cand.*; 355					*b*			
microcarpa, *F. M.*; 357					*b*		*d*	
montana, *Benth.*; 357		M				*c*		
verniciflua, *A. Cunn.*; 358						*c*		
dodonæifolia, *Willd.*; 359			E		*b*			*k*
sentis, *F. M.*; 360	C			*a*				
retinodes, *Schlecht.*; 362			E	*a*	*b*	*c*		*k*
neriifolia, *A. Cunn.*; 363				*a*				
notabilis, *F. M.*; 365			E	*a*	*b*		*d*	
pycnantha, *Benth.*; 365					*b*	*c*		
hakeoides, *A. Cunn.*; 367							*d*	
salicina, *Lind.*; 367	C	M		*a*	*b*	*c*	*d*	
suaveolens, *Willd.*; 369			E					
Murrayana, *F. M.*; 370	C							
prominens, *A. Cunn.*; 371				*a*				
brachybotrya, *Benth.*; 373		M			*b*		*d*	
Wattsiana, *F. M.*; 374				*a*				
myrtifolia, *Willd.*; 376			E			*c*		
sublanata, *Benth.*; 378				*a*	*b*			
minutifolia, *F. M.*; Frag. viii., 243	C							
homalophylla, *A. Cunn.*; 383	C				*b*			
Oswaldi, *F. M.*; 384		M			*b*	*c*	*d*	
stenophylla, *A. Cunn.*; 385		M						
sclerophylla, *Lind.*; 386		M			*b*	*c*	*d*	
farinosa, *Lind.*; 386		M		*a*	*b*	*c*		*k*
melanoxylon, *R. Brown*; 388			E			*c*		
retivenia, *F. M.*; 392	C							
longifolia, *Willd.*; 397		M	E			*c*	*d*	
Burkitti, *F. M.*; 400	C							
cyperophylla, *F. M.*; 400	C							
aneura, *F. M.*; 402	C			*a*				
decurrens, *Willd.*; 414			E					
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Geum urbanum, *Linné*; 428			E					
Potentilla anserina, *Linné*; 429			E					
Rubus parviflorus, *Linné*; 430			E			*c*		
Alchemilla arvensis, *Scop.*; 432			E			*c*		
vulgaris, *Linné*; 432			E					
Acæna ovina, *A. Cunn.*; 433					*b*	*c*	*d*	
sanguisorbæ, *Vahl.*; 434			E			*c*		*k*
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Bauera rubioides, *Andr.*; 447						*c*		
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Tillæa verticillaris, *A. Cunn.*; 451	C				*b*	*c*	*d*	

Tillæa purpurata, *Hooker*; 451				*a*			*d*	
macrantha, *Hooker*; 452						*c*	*d*	
intricata, *Nees*; 452		M		*a*		*c*		
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Loudonia aurea, *Lind.*; 472	C			*a*				
Behrii, *Schlecht.*; 472		M			*b*	*c*		*k*
Haloragis mucronata, *Nees*; 475		M	E			*c*		*k*
elata, *A. Cunn.*; 476				*a*		*c*		
Gossei, *F. M.*; Frag. viii., 161	C							
ceratophylla, *Endl.*; 478		M		*a*	*b*	*c*	*d*	
acutangula, *F. M.*; 478					*b*			
odontocarpa, *F. M.*; 479	C							
micrantha, *R. Brown*; 482						*c*		
heterophylla, *Brong.*; 483						*c*		
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Meionectes Brownii, *J. Hooker*; 486		M	E			*c*		
Myriophyllum variæfolium, *J. Hooker*; 487		M	E			*c*		
elatinoides, *Gaud.*; 487		M				*c*		
verrucosum, *Lind.*; 488		M	E			*c*		
Muelleri, *Sond.*; 488						*c*		
integrifolium, *J. Hooker*; 490		M	E					
Callitriche verna, *Linné*; 492			E					
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Epilobium tetragonum, *Linné*; 305, &c.			E		*b*	*c*		
var. pallidiflorum						*c*		
Jussiæa repens, *Linné*; 306.		M	E					
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Verticordia Wilhelmi, *F. M.*; 19					*b*			
Calycothrix longiflora, *F. M.*; 49	C							
tetragona, *Labill.*; 50		M	E	*a*	*b*	*c*	*d*	*k*
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genetylloides, *F. M.*; 54		M						

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Mitchelliana, *F. M.*; 61		m						
Miquelliana, *F. M.*; 62					*b*			
ericæa, *F. M.*; 62								*k*
Elliotti, *F. M.*; Frag. ix., 62	c							
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Bæckea crassifolia, *Lind.*; 76		m		*a*	*b*	*c*	*d*	*k*
polystemonea, *F. M.*; 77	c							
ericæa, *F. M.*; 77		m						
Behrii, *F. M.*; 83	c	m			*b*	*c*		
Leptospermum lævigatum, *F. M.*; 103	c	m		*a*	*b*	*c*		*k*
scoparium, *Forster*; 105			e	*a*		*c*		*k*
lanigerum, *Smith*; 106			e			*c*		
myrsinoides, *Schlecht.*; 109		m				*c*		*k*
Kunzea pomifera, *F. M.*; 116			e			*c*		
Callistemon coccineus, *F. M.*; 120		m			*b*	*c*	*d*	*k*
salignus, *Smith*; 120		m				*c*		
teretifolius, *F. M.*; 122				*a*		*c*		
brachyandrus, *Lind.*; 122		m						
Melaleuca acuminata, *F. M.*; 132		m			*b*	*c*	*d*	*k*
gibbosa, *Labill.*; 133			e					*k*
decussata, *R. Brown*; 133		m			*b*	*c*		
Wilsoni, *F. M.*; 134		m			*b*			
squarrosa, *Smith*; 139			e					*k*
parviflora, *Lindley*; 145	c	m	e		*b*	*c*	*d*	*k*
cylindrica, *R. Brown*; 146								*k*
uncinata, *R. Brown*; 150		m			*b*		*d*	*k*
glomerata, *F. M.*; 151	c							
squamea, *Labill.*; 155			e					
ericifolia, *Smith*; 159		m						
var. pustulata, *Hooker*; 160		m				*c*	*d*	*k*
Eucalyptus pauciflora, *Sieb.*; 201			e					
Sieberiana, *F. M.*; 202			e					
obliqua, *L'Heritier*; 204			e			*c*		
capitellata, *Smith*; 206			e					
santalifolia, *F. M.*; 206			e		*b*	*c*		
var. (?) Baxteri; 207								*k*
leucoxylon, *F. M.*; 210		?	?			*c*		
gracilis, *F. M.*; 211	c	m		*a*			*d*	
paniculata, *Smith*; 211		m	e			*c*		*k*
largiflorens, *F. M.*; 214		m				*c*		
uncinata, *Turcz.*; 216		m				*c*	*d*	
odorata, *Behr*; 215			e	*a*	*b*	*c*	*d*	
Behriana, *F. M.*; 216		?			*b*			*k*
corynocalyx, *F. M.*; 218			?	*a*	*b*			

Eucalyptus hemiphloia, *F. M.*; 219, 216				*a*				
microtheca, *F. M.*; 223	c							
cosmophylla, *F. M.*; 225						*e*		*k*
goniocalyx, *F. M.*; 229								
dumosa, *A. Cunn.*; 230		M	E			*e*	*d*	
var. conglobata					*b*			
incrassata, *Labill.*; 231	c	M					*d*	
pachyphylla, *F. M.*; 237	c							
Youngiana, *F. M.*; Frag. x., 5	c							
viminalis, *Labill.*; 239			E			*e*		*k*
rostrata, *Schlecht.*; 240	c	M	E			*e*		
Gunnii, *Hooker*; 246			E					
oleosa, *F. M.*; 248	c	M			*b*		*d*	*k*
gamophylla, *F. M.*; Frag. xi., 40	c							
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linariæfolia, *A. Cunn.*; 407	c	M		*a*	*b*	*e*	*d*	
megaloptera, *F.M.*; Fg. viii., 35	c							
Macgregoria racemigera, *F.M.*; Fg. viii., 161	c							
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Pomaderris apetala, *Labill.*; 419				*a*				*k*
obcordata, *Fenzl*; 421			E	*a*	*b*		*d*	
racemosa, *Hooker*; 421	c	M		*a*	*b*	*e*	*d*	
Spyridium parvifolium, *F. M.*; 428			E			*e*		
spathulatum, *R. Brown*; 430			E		*b*	*e*		*k*
phlebophyllum, *F. M.*; 430				*a*				
coactilifolium, *Benth.*; 431						*e*		
halmaturinum, *F. M.*; 432								*k*
bifidum, *F. M.*; 432					*b*			
subochreatum, *Reissek*; 433	c	M	E		*b*			
eriocephalum, *Fenzl*; 434		M	E	*a*		*e*	*d*	
var. vexilliferum; 433		M	E			*e*		
leucophractum, *F. M.*; 435	c	M		*a*		*e*	*d*	*k*
Waterhousei, *F. M.*; 436								*k*
Cryptandra hispidula, *Reissek*; 439		M				*e*		
amara, *Smith*; 440						*e*	*d*	
tomentosa, *Lind.*; 441	c	M		*a*		*e*	*d*	
propinqua, *A. Cunn.*; 442		M						
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Pimelea glauca, *R. Brown*; 15		M	E	*a*	*b*	*e*	*d*	

Pimelea spathulata, *Labill.*; 17						*c*		
ligustrina, *Labill.*; 18			E					
var. macrostegia								*k*
humilis, *R. Brown*; 19					*b*	*c*		
simplex, *F. M.*; 23	C	M		*a*				
trichostachya, *Lind.*; 24	C	M						
microcephala, *R. Brown*; 27	C	M	E		*b*			*k*
elachantha, *F. M.*; 28		M	E					
serpyllifolia, *R. Brown*; 29	C	M		*a*	*b*	*c*	*d*	
flava, *R. Brown*; 29		M			*b*	*c*		*k*
petrophila, *F. M.*; 30				*a*				
ammocharis, *F. M.*; 30	C							
curviflora, *R. Brown*; 31		M			*b*	*c*	*d*	
octophylla, *R. Brown*; 32		M		*a*	*b*	*c*	*d*	*k*
petræa, *Meissn.*; 33	C	M		*a*				
phylicoides, *Meissn.*; 33		M				*c*	*d*	
stricta, *Meissn.*; 34						*c*		*k*
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Petrophila multisecta, *F. M.*; 335								*k*
Isopogon ceratophyllus, *R. Brown*; 347		M	E			*c*		
Adenanthos terminalis, *R. Brown*; 335			E		*b*	*c*		*k*
Conospermum patens, *Schlecht.*; 371		M				*c*		*k*
Persoonia juniperina, *Labill.*; 403		M				*c*		
Grevillea pterosperma, *F. M.*; 432	C	M						
ilicifolia, *R. Brown*; 437		M		*a*	*b*		*d*	*k*
Treueriana, *F. M.*; Frag. ix., 123	C							
juncifolia, *Hooker*; 447	C							
lavandulacea, *Schlecht.*; 448		M	E	*a*		*c*		
aspera, *R. Brown*; 450	C				*b*			
pauciflora, *R. Brown*; 453			E		*b*			
angulata, *R. Brown*; 455	C							
Wickhami, *Meissn.*; 455	C							
Huegeli, *Meissn.*; 457		M	E	*a*	*b*	*c*	*d*	
striata, *R. Brown*; 462	C							
parviflora, *R. Brown*; 472; *var.* acuaria, *F. M.*			E					*k*
nematophylla, *F. M.*; 482	C							
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Pampliniana, *Kippist*; 507		M			*b*	*c*		
vittata, *R. Brown*; 507					*b*			
rostrata, *F. M.*; 508			E			*c*		*k*
rugosa, *R. Brown*; 508		M			*b*	*c*	*d*	*k*
acicularis, *R. Brown*; 514			E					
leucoptera, *R. Brown*; 515	C	M			*b*			

Hakea cycloptera, *R. Brown*; 515					*b*			
multilineata, *Meissn.*; 518	c							
ulicina, *R. Brown*; 524			E			*c*		
flexilis, *F. M.*; 530		M				*c*	*d*	*k*
Banksia marginata, *Cav.*; 553			E		*b*	*c*		*k*
ornata, *F. M.*; 557			E			*c*		
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Loranthus celastroides, *Sieb.*; 389			E					
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Exocarpi, *Behr*; 392	c	M		*a*	*b*	*c*	*d*	
var. (?) linearifolius; 391	c							
linophyllus, *Fenzl*; 393	c	M		*a*	*b*	*c*	*d*	
pendulus, *Sieb.*; 394	c		E			*c*		
var. Melaleucæ	c				*b*		*d*	
var. canus; 395	c							
graudibracteus, *F. M.*; 395	c							
Viscum articulatum, *Burm.*; 396	c							
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Santalum lanceolatum, *R. Brown*; 214	c							
acuminatum, *De Cand.*; 216	c	M			*b*		*d*	
persicarium, *F. M.*; 216		M				*c*	*d*	
Choretrum glomeratum, *R. Brown*; 218					*b*	*c*	*d*	*k*
chrysanthum, *F. M.*; 218		M		*a*			*d*	
spicatum, *F. M.*; 218		M						*k*
Leptomeria aphylla, *R. Brown*; 222		M	E		*b*	*c*		
Anthobolus exocarpoides. *F. M.*; Fg. ix., 3	c							
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spartea, *R. Brown*; 229		M			*b*	*c*	*d*	
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stricta, *R. Brown*; 230		M	E	*a*	*b*			
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Hydrocotyle vulgaris, *Linné*; 339		M	E			*c*		
hirta, *R. Brown*; 340			E			*c*		
laxiflora, *De Cand.*; 340			E	*a*		*c*		
callicarpa, *Bunge*; 343		M				*c*	*d*	
trachycarpa, *F. M.*; 343	c							
capillaris, *F. M.*; 344			E				*d*	*k*
Asiatica, *Linné*; 346			E			*c*		
Didiscus pilosus, *Benth.*; 348					*b*	*c*		
cyanopetalus, *F. M.*; 348		M					*d*	
eriocarpus, *F. M.*; 348				*a*			*d*	

Didiscus anisocarpus, *F. M.*; 349			E					
glaucifolius, *F. M.*; 350	C			*a*				
Trachymene heterophylla, *F. M.*; 354			E		*b*	*c*		
Xanthosia pusilla, *Bunge*; 361						*c*		
dissecta, *J. Hooker*; 362		M	E		*b*			*k*
Eryngium rostratum, *Cav.*; 370			E			*c*		
vesiculosum, *Labill.*; 370			E			*c*		
plantagineum, *F. M.*; 371	C							
Apium prostratum, *Labill.*; 372		M	E	*a*	*b*	*c*	*d*	
Crantzia lineata, *Nutt.*; 374			E			*c*		
Daucus brachiatus, *Sieb.*; 376	C	M	E	*a*	*b*	*c*	*d*	
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Oldenlandia tillæacea, *F. M.*; 405	C							
Dentella repens, *Forst.*; 406	C							
Canthium latifolium, *F. M.*; 421	C							
Coprosoma hirtella, *Labill.*; 529			E					
Opercularia scabrida, *Schlecht.*; 433						*c*		
ovata, *J. Hooker*; 435						*c*		
varia, *J. Hooker*; 435			E			*c*	*d*	
Pomax umbellata, *Solander*; 437	C				*b*			
Asperula oligantha, *F. M.*; 444		M	E			*c*	*d*	
Galium geminifolium, *F. M.*; 445		M						
Gaudichaudi, *De Cand.*; 446		M	E	*a*		*c*	*d*	
australe, *De Cand.*; 446		M		*a*			*d*	*k*
COMPOSITÆ (Fl. Aust., vol. III.)								
Adenostemma viscosum, *Forst.*; 462		M						
Aster grandiflorus, *F. M.*; 469						*c*		
pannosus, *F. M.*; 469		M	E	*a*	*b*	*c*	*d*	
myrsinoides, *Labill.*; 470			E					
tubuliflorus, *F. M.*; 475						*c*		
axillaris, *F. M.*; 475	C		E			*c*	*d*	*k*
ramulosus, *Labill.*; 476			E		*b*	*c*	*d*	
floribundus, *F. M.*; 477					*b*			
microphyllus, *Labill.*; 477	C	M		*a*	*b*	*c*	*d*	
subspicatus, *F. M.*; 478	C	M					*d*	
pimeleoides, *A. Cunn.*; 479	C	M		*a*				
conocephalus, *F. M.*; 480	C	M			*b*			
magniflorus, *F. M.*; 480	C	M			*b*			
calcareus, *F. M.*; 481		M		*a*	*b*			
Muelleri, *Sonder*; 481	C	M		*a*	*b*		*d*	
Stuartii, *F. M.*; 481	C							
decurrens, *De Cand.*; 481				*a*	*b*		*d*	

Aster glutescens, *F. M.*; 482 pars		M				*c*	*d*	
teretifolius, *F. M.*; 482						*c*	*d*	*k*
glandulosus, *Labill.*; 483			E					
megalodontus, *F. M.*; Frag. viii., 244	C							
Ferresi, *F. M.*; 487	C							
exul, *Lind.*]; 487		M			*b*		*d*	
var. glabriuscula			E			*c*		
picridifolius, *F. M.*; 487				*a*			*d*	
Huegeli, *F. M.*; 488		M	E	*a*	*b*	*c*	*d*	
var. squamifolia								*k*
Vittadinia australis, *A. Rich.*; 490	C	M	E	*a*	*b*	*c*	*d*	
Podocoma cuneifolia, *R. Brown*; 493	C			*a*				
Minuria leptophylla, *De Cand.*; 498	C	M		*a*	*b*	*c*	*d*	
Cunninghami, *De Cand.*; 498				*a*			*d*	
Candollei, *F. M.*; Frag. x., 56	C	M						
suædifolia, *F. M.*; 499	C	M		*a*	*b*		*d*	
Calotis cunefolia, *R. Brown*; 501		M						
cymbacantha, *F. M.*; 502	C			*a*				
erinaceâ, *Steetz*; 502	C	M		*a*	*b*	*c*		
scabiosifolia, *Sond. & F. M.*; 503				*a*				
scapigera, *Hooker*; 503		M						
lappulacea, *Benth.*; 504	C			*a*			*d*	
plumulifera, *F. M.*; 505	C							
porphyroglossa, *F. M.*; 505	C							
hispidula, *F. M.*; 506	C			*a*			*d*	
Lagenophora Billardieri, *Cass.*; 507			E					
Huegeli, *Benth.*; 507						*c*	*d*	
emphysopus, *J. Hooker*; 508			E			*c*		
Brachycome diversifolia, *Fisch. & May.*; 511			E			*c*		
goniocarpa, *Sond. & F. M.*; 512		M		*a*				
pachyptera, *Turcz.*; 512		M			*b*	*c*	*d*	
Tatei, *F. M.*; (*m.s.*)	C							
Muelleri, *Sonder.*; 514						*c*		
graminea, *F. M.*; 514	C	M	E			*c*		
basaltica, *F. M.*; 515						*c*		
trachycarpa, *F. M.*; 515				*a*		*c*		
exilis, *Sonder.*; 516		M			*b*	*c*		
debilis, *Sonder.*; 516					*b*	*c*		
decipiens, *J. Hooker*; 516			E					
cardiocarpa, *F. M.*; 517			E					
ciliaris, *Labill.*; 518		M	E	*a*	*b*	*c*	*d*	
calocarpa, *F. M.*; 519		M		*a*				
tenella, *Turcz.*; 521						*c*	*d*	
Pterocaulon sphacelatus, *Hook. & Benth.*; 523	C							
Billardieri, *F. M.*; Frag.	C							
Erodiophyllum Elderi, *F. M.*; Frag. ix., 120	C							
Pluchea Eyrea, *F. M.*; 528	C			*a*				

Epaltes australis, *Less.*; 530	c	M	E				
Pterigeron liatroides, *Benth.*; 532	c						
microglossus, *Benth.*; 532	c						
dentatifolius, *F. M.*; Fg. ix., 119	c						
Siegesbeckia orientalis, *Linné*; 535				*b*	*c*		
Wedelia platyglossa, *F. M.*; 536		M			*c*		
Glossogyne tenuifolia, *Cass.*; 544	c		*a*				
Flaveria Australasica, *Hooker*; 546	c						
Cotula filifolia, *Thunb.*; 548		M	*a*		*c*		
coronopifolia, *Linné*; 540		M	E		*c*		*k*
australis, *Hooker*; 550			E		*c*		
reptans, *Benth.*; 551			E				
Centipeda orbicularis, *Lour.*; Fg. viii., 142		M	E				
Cunninghami, *F. M.*; 553 pars		M		*b*	*c*	*d*	*k*
thespidioides, *F. M.*; Fg. viii., 143	c	M					
Elachanthus pusillus, *F. M.*; 555			*a*	*b*		*d*	
Isoetopsis graminifolia, *Turcz.*; 556		M	*a*	*b*	*c*	*d*	
Myriocephalus rhizocephalus, *De Cand.*; 557		M				*d*	*k*
Rudalli, *F. M.*; 559	c						
Polycalymma Stuarti, *Sond. et M.*; 860	c	M					
Angianthus tomentosus, *Wendl.*; 562	c	M		*b*	*c*	*d*	
pleuropappus, *Benth.*; 563				*b*			
brachypappus, *F. M.*; 563	c						
tenellus, *F. M.*; 564				*b*			
pusillus, *Benth.*; 564	c	M	*a*				
Preissianus, *Steetz*; 566			E	*b*	*c*		
strictus, *Steetz*; 568			*a*		*c*	*d*	
Gnephosis Burkitti, *Benth.*; 570	c						
eriocarpa, *F. M.*; 570	c						
skirrophora, *Benth.*; 570	c		*a*			*d*	
arachnoidea, *Turcz.*; 571			*a*				
cadonopappa, *F. M.*; Fg. ix., 2	c						
Calocephalus Brownii, *F. M.*; 574			E	*b*		*d*	*k*
Sonderi, *F. M.*; 575		M					
lacteus, *Less.*; 575					*c*		
citreus, *Less.*; 575			E		*c*	*d*	
platycephalus, *F. M.*; 576	c						
Cephalipterum Drummondi, *A. Gray*; 577	c						
Gnaphalodes uliginosum, *A. Gray*; 578		M	*a*		*c*	*d*	
Craspedia Richea, *Cass.*; 579		M	E	*a*	*b*	*c*	*d*
pleiocephala, *F. M.*; 580		M		*a*			
chrysantha, *Schlecht.*; 580	c				*c*		
globosa, *Benth.*; 580			E	*a*			
Chthonocephalus pseudoevax, *Steetz*; 582	c						
Ixodia achilleoides, *R. Brown*; 583		M		*a*	*b*	*c*	*k*
Cassinia longifolia, *R. Brown*; 586			E				
aculeata, *R. Brown*; 586		M				*d*	

Cassinia laevis, *R. Brown*; 587					*b*		*d*	
arcuata, *R. Brown*; 587		M			*b*		*d*	
spectabilis, *Labill.*; 588								*k*
Humea cassiniacea, *F. M.*; 589					*b*		*d*	
punctulata, *F. M.*; 589				*a*	*b*			
Eriochlamys Behrii, *Sond. & F. M.*; 591		M		*a*	*b*	*c*		
Toxanthus perpusillus, *Turcz.*; 592		M		*a*			*d*	
Muelleri, *Benth.*; 592	C	M						
Rutidosis helichrysoides, *De Cand.*; 594	C	M		*a*				
Pumilo, *Benth.*; 595						*c*	*d*	
Millotia tenuifolia, *Cass.*; 596		M	E	*a*	*b*	*c*	*d*	
Greevesii, *F. M.*; 596		M						
Ixiolæna leptolepis, *De Cand.*; 597	C	M		*a*				
supina, *F. M.*; 598					*b*			*k*
tomentosa, *Sond. & F. M.*; 598	C	M		*a*	*b*			
Athrixia tenella, *Benth.*; 600		M		*a*	*b*		*d*	
Podotheca angustifolia, *Cass.*; 601		M				*c*	*d*	
Podolepis acuminata, *R. Brown*; 604			E			*c*	*d*	
canescens, *A. Cunn.*; 605	C	M	E	*a*	*b*	*c*	*d*	
rugata, *Labill.*; 606		M		*a*	*b*	*c*	*d*	
Lessoni, *Benth.*; 606				*a*		*c*	*d*	
Siemssenia, *F. M.*; 607	C			*a*				
Leptorhynchus squamatus, *Labill.*; 608						*c*	*d*	
ambiguus, *Turcz.*; 609	C			*a*				
pulchellus, *F. M.*; 610		M		*a*	*b*	*c*	*d*	
elongatus, *DeC.*; 616, Fg. xi., 85				*a*		*c*	*d*	
medius, *A. Cunn.*; 610, Fg. xi., 85	C						*d*	
Waitzia, *Sonder.*; 610		M		*a*	*b*	*c*	*d*	
Helichrysum Cassinianum, *Gaud.*; 611	C							
Davenporti, *F. M.*; 616	C							
semifertile, *F. M.*; 617	C			*a*				
Baxteri, *A. Cunn.*; 617		M		*a*		*c*	*d*	
scorpioides, *Labill.*; 618			E			*c*		
rutidolepis, *De Cand.*; 618	C					*c*		
obtusifolium, *F.M. & Sond.*; 619			E			*c*	*d*	*k*
lucidum, *Henckel*; 620	C	M	E	*a*	*b*	*c*	*d*	
retusum. *F. M.*; Frag. viii., 46		M		*a*	*b*	*c*	*d*	
decurrens, *F. M.*; Frg. viii., 46		M						
diotophyllum, *F. M.*; 628		M						
adenophorum, *F. M.*; 622								*k*
leucopsidium, *De Cand.*; 622		M	E	*a*	*b*	*c*	*d*	
Blandowskianum, *Steetz*; 622			E			*c*		
podolepideum, *F. M.*; 624	C							
apiculatum, *De Cand.*; 624	C	M	E	*a*	*b*	*c*	*d*	
semipapposum, *De Cand.*; 625		M	E	*a*	*b*	*c*	*d*	
ferrugineum, *Labill.*; 631			E					
Thomsoni, *F. M.*; Fg. viii., 45	C							

Helichrysum Ayersii, *F. M.*; Fg. viii., 167	c							
Waitzia corymbosa, *Wendl.*; 635	c							
Helipterum roseum, *Benth.*; 640	c							
anthemoides, *De Cand.*; 641		M		*a*		*c*		
polygalifolium, *De Cand.*; 641	c	M			*b*			
floribundum, *De Cand.*; 642	c	M		*a*			*d*	
var. Stuartinum, *Sond.*		M						
heteranthum, *Turcz.*; 642							*d*	
involueratum, *F. M.*; 646	c							
tenellum, *Turcz.*; 646	c				*b*			
strictum, *Benth.*; 646	c			*a*				
stipitatum, *F. M.*; 643	c							
incanum, *De Cand.*; 643	c	M		*a*				
Cotula, *De Cand.*; 644	c	M						
hyalospermum, *F. M.*; 644	c			*a*		*c*	*d*	
Haigii, *F. M.*; Frag. x., 107	c							
corymbiflorum, *Schlecht.*; 647				*a*		*c*	*d*	
pygmæum, *De Cand.*; 647		M		*a*	*b*	*c*	*d*	
Charsleyæ, *F. M.*; Fg. viii., 168	c							
moschatum, *A. Cunn.*; 648	c			*a*		*c*		
Tietkensi, *F. M.*; Fg. viii., 227	c							
pterochætum, *F. M.*; 648	c			*a*				
exiguum, *F. M.*; 649	c		E			*c*	*d*	
dimorpholepis, *Benth.*; 650				*a*			*d*	
Gnaphalium luteo-album, *Linné*; 653	c	M	E	*a*	*b*	*c*	*d*	*k*
Japonicum, *Thunb.*; 653	c		E		*b*	*c*	*d*	*k*
indutum, *Hooker*; 655		M	E	*a*			*d*	
Stuartina Muelleri, *Sonder.*; 657			E	*a*		*c*	*d*	
Erechthites pieridioides, *Turcz.*; 658	c						*d*	
arguta, *De Cand.*; 659	c		E	*a*		*c*		*k*
mixta, *De Cand.*; 659		M			*b*			
quadridentata, *De Cand.*; 660				*a*		*c*	*d*	
hispidula, *De Cand.*; 660						*c*	*d*	
Senecio Gregorii, *F. M.*; 663	c							
megaglossus, *F. M.*; 665				*a*				
magnificus, *F. M.*; 665	c			*a*				
lautus, *G. Forst.*; 667	c	M	E		*b*	*c*	*d*	*k*
Behrianus, *Sond. & Muell.*; 669		M						
brachyglossus, *F. M.*; 669	c	M		*a*	*b*	*c*	*d*	
Georgianus, *De Cand.*; 670		M				*c*		
odoratus, *Hornem.*; 671	c		E		*b*	*c*		*k*
hypoleucus, *Benth.*; 672						*c*		
Cunninghami, *De Cand.*; 671	c	M		*a*		*c*	*d*	
anethifolius, *A. Cunn.*; 672				*a*				
Cymbonotus Lawsonianus, *Gaudich.*; 674						*c*	*d*	
Microseris Forsteri, *Hooker*; 676		M	E	*a*		*c*	*d*	
Picris hieracioides, *Linné*; 678		M	E		*b*	*c*	*d*	*k*

STYLIDIEÆ (Fl. Aust., vol. IV.)								
Stylidium graminifolium, *Swartz*; 10			E			*c*		
calcaratum, *R. Brown*; 14						*c*		
floribundum, *R. Brown*; 15	C							
despectum, *R. Brown*; 22			E	*a*		*c*		
Leeuwenhookia dubia, *Sonder*; 34		M	E			*c*	*d*	
CAMPANULACEÆ (Fl. Aust., vol. IV.)								
Lobelia heterophylla, *Labill.*; 124	C							
Browniana, *Roem. & Schult.*			E					
microsperma, *F. M.*; Frag. x., 41					*b*	*c*	*d*	*k*
simplicicaulis, *R. Brown*; 124			E					
rhombifolia, *De Vr.*; 126						*c*		
anceps, *Thunb.*; 128			E		*b*	*c*		*k*
pratioides, *Benth.*; 131			E					
Benthami, *F. M.*; 133 *(puberula)*	C							
concolor, *R. Brown*; 133		M						
Isotoma petræa, *F. M.*; 135	C			*a*				
scapigera, *Don*; 136					*b*			
fluviatilis, *F. M.*; 136			E					
Wahlenbergia gracilis, *De Cand.*; 137	C	M	E	*a*	*b*	*c*	*d*	
GOODENOVIEÆ (Fl. Aust., vol. IV.)								
Leschenaultia divaricata, *F. M.*; 43	C							
striata, *F. M.*; Fg. viii., 245	C							
Velleia connata, *F. M.*; 46	C							
paradoxa, *R. Brown*; 48		M	E		*b*	*c*	*d*	
Goodenia Rameli, *F. M.*; 57	C							
ovata, *Smith*; 59			E			*c*	*d*	*k*
amplexans, *F. M.*; 60						*c*		
varia, *R. Brown*; 61	C	M		*a*	*b*	*c*		
geniculata, *R. Brown*; 62		M	E	*a*	*b*	*c*	*d*	
hirsuta, *F. M.*; 64	C							
Vilmoriniæ, *F. M.*; 68	C							
Nicholsoni, *F. M.*; 69	C							
grandiflora, *Sims*; 69	C							
Chambersi, *F. M.*; 70	C							
calcarata, *F. M.*; 69	C			*a*				
albiflora, *Schlecht.*; 70						*c*	*d*	
Mitchelli, *Benth.*; 71	C							
heterochila, *F. M.*; 71	C							
Mueckeana, *F. M.*; Frag. viii., 56	C							
cycloptera, *R. Brown*; 74	C						*d*	
pinnatifida, *Schlecht.*; 75		M		*a*	*b*	*c*	*d*	
glauca, *F. M.*; 76	C	M						
microptera, *F. M.*; 77	C							

Selliera radicans, *Cav.*; 82					*b*	*c*		
Catosperma Muelleri, *Benth.*; 83	C							
Scævola spinescens, *R. Brown*; 87	C	M		*a*	*b*		*d*	
depauperata, *R. Brown*; 91	C							
parvifolia, *F. M.*; 91	C							
collaris, *F. M.*; 92	C							
suaveolens, *R. Brown*; 95		M	E					
ovalifolia, *R. Brown*; 96	C							
crassifolia, *Labill.*; 96	C		E	*a*	*b*	*c*	*d*	
æmula, *R. Brown*; 99	C		E	*a*	*b*			
humilis, *R. Brown*; 100	C				*b*			
microcarpa, *Cav.*; 101			E	*a*		*c*		
linearis, *R. Brown*; 102					*b*	*c*		*k*
Dampiera lanceolata, *A. Cunn.*; 113		M						
rosmarinifolia, *Schlecht.*; 114	C	M	E	*a*	*b*	*c*	*d*	
stricta, *R. Brown*; 115			E					
Brunonia australis, *Smith*; 121	C		E			*c*		
GENTIANEÆ (Fl. Aust., vol. IV.)								
Sebæa ovata, *R. Brown*; 371		M	E			*c*	*d*	*k*
Erythræa australis, *R. Brown*; 371	C		E	*a*	*b*	*c*	*d*	
Gentiana montana, *G. Forst.*; 373		M	E					
Limnanthemum exaltatum, *F. M.*; 376		M	E			*c*		
crenatum, *F. M.*; 379		M						
LOGANIACEÆ (Fl. Aust., vol. IV.)								
Mitrasacme paradoxa, *R. Brown*; 359			E	*a*				
Logania longifolia, *R. Brown*; 361				*a*		*c*		
crassifolia, *R. Brown*; 362		M	E		*b*			
ovata, *R. Brown*; 362			E		*b*	*c*	*d*	*k*
linifolia, *Schlecht.*; 363		M				*c*	*d*	
nuda, *F. M.*; 365		M						
PLANTAGINEÆ (Fl. Aust., vol. V.)								
Plantago varia, *R. Brown*; 139	C	M	E	*a*	*b*	*c*	*d*	*k*
var. (?) parviflora								*k*
PRIMULACEÆ (Fl. Aust., vol. IV.)								
Samolus repens, *Pers.*; 271	C	M	E		*b*	*c*	*d*	
JASMINEÆ (Fl. Aust., vol. IV.)								
Jasminum lineare, *R. Brown*; 295	C							
calcareum, *F. M.*; 297	C							
APOCYNEÆ (Fl. Aust., vol. IV.)								
Carissa Brownii, *F. M.*; 305	C							
Alyxia buxifolia, *R. Brown*; 307	C	M	E	*a*	*b*	*c*	*d*	

Notonerium Gossei, *Benth.*; Gen. Plant., 698	c							
ASCLEPIADEÆ (Fl. Aust., vol. IV.)								
Sarcostemma australe, *R. Brown*; 328	c			*a*				
Cynanchum floribundum, *R. Brown*; 332	c			*a*				
Marsdenia Leichhardtiana, *F. M.*; 341	c							
SOLANACEÆ (Fl. Aust., vol. IV.)								
Solanum aviculare, *G. Forst.*; 447			E					
simile, *F. M.*; 448	c	M		*a*	*b*		*d*	*k*
fasciculatum, *F. M.*; Frag. vi., 144	c						*d*	
ferocissimum, *Lindley*; 451	c							
oligacanthum, *F. M.*; 454	c							
esuriale, *Lindley*; 454	c	M		*a*	*b*	?		
chenopodinum, *F. M.*; 454	c							
Sturtii, *F. M.*; 454	c			*a*				
hystrix, *R. Brown*; 458					*b*			
eremophilum, *F. M.*; 459				*a*				
lacunarium, *F. M.*; 461	c							
petrophilum, *F. M.*; 461	c			*a*				
ellipticum, *R. Brown*; 464	c			*a*				
Lycium australe, *F. M.*; 467	c	M				*c*	*d*	
Datura Leichhardti, *F. M.*; 468	c							
Nicotiana sauveolens, *Lehm.*; 469	c	M	E	*a*	*b*	*c*	*d*	
Anthocercis anisantha, *Endlicher*; 477	c				*b*			
angustifolia, *F. M.*; 478						*c*		
myosotidea, *F. M.*; 478		M						
Eadesii, *F. M.*; 480		M						
Duboisia Hopwoodi, *F. M.*; 480	c							
Anthrotroche Blackii, *F. M.*; Frag. viii., 232	c							
SCROPHULARIACEÆ (Fl. Aust., vol. IV.)								
Mimulus repens, *R. Brown*; 482	c	M		*a*	*b*	*c*		
gracilis, *R. Brown*; 482	c							
prostratus, *Benth.*; 483	c							
Stemodia viscosa, *Roxb.*; 486	c							
pedicellaris, *F. M.*; Frag. viii., 231	c							
Morgania, *F. M.*; 488	c			*a*		*c*		
Gratiola peruviana, *Linné*; 493			E			*c*		*k*
Limosella aquatica, *Linné*; 503		M		*a*		*c*		*k*
Curdieana, *F. M.*; Frag. ix., 166	c	M						
Veronica decorosa, *F. M.*; 506				*a*				
Derwentia, *Littlejohn*; 507			E			*c*		
gracilis, *R. Brown*; 508			E			*c*		
distans, *R. Brown*; 509		M		*a*	*b*			
calycina, *R. Brown*; 509			E				*d*	*k*
Euphrasia Brownii, *F. M.*; 520	c	M	E	*a*	*b*	*c*	*d*	

Euphrasia scabra, *R. Brown*; 521			E		*b*	*c*	
ACANTHACEÆ (Fl. Aust., vol. IV.)							
Ruellia australis, *R. Brown*; 547	C						
Justicia procumbens, *Linné*; 549	C			*a*			
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Muelleri, *Benth.*; 423	C						
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Breweria rosea, *F. M.*; 436	C						
Cressa cretica, *Linné*; 437		M				*c*	
Evolvulus linifolius, *Linné*; 437	C						
Dichondra repens, *G. Forst.*; 438			E			*c*	
Wilsonia humilis, *R. Brown*; 439		M		*a*	*b*	*c*	
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Cuscuta australis, *R. Brown*; 441			E				
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Heliotropium Curassavicum, *Linné*; 393	C	M	E				
europæum, *Linné*; 394	C	M		*a*		[*c*]	
undulatum, *Vahl.*; 394	C						
asperrimum, *R. Brown*; 394	C			*a*			
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Myosotis australis, *R. Brown*; 405		M	E			*c*	*d*	
Eritrichium australasicum, *De Cand.*; 406		M		*a*			*d*	
Echinospermum concavum, *F. M.*; 407		M			*b*	*c*	*d*	
Cynoglossum suaveolens, *R. Brown*; 409		M			*b*	*c*	*d*	
australe, *R. Brown*; 409			E					
Drummondi, *Benth.*; 409	c	M		*a*				
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satureioides, *R. Brown*; 84			E		*b*	*c*	*d*	
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Prunella vulgaris, *Linné*; 87			E			*c*		
Scutellaria mollis, *R. Brown*; 88			E					
humilis, *R. Brown*; 88								*k*
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spinosa, *F. M.*; 99		M			*b*			*k*
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Wilkieana, *F. M.*; Fg. viii., 230	c							
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coccinea, *F. M.*; 107		M			*b*	*c*	*d*	*k*
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Microcorys Macredieana, *F. M.*; Fg. viii., 231	c							
Westringia rigida, *R. Brown*; 129	c	M			*b*	*c*	*d*	
Dampieri, *R. Brown*; 129	c				*b*			
Teucrium racemosum, *R. Brown*; 132	c	M			*b*	*c*	*d*	
corymbosum, *R. Brown*; 133	c		E	*a*				
sessiliflorum, *Benth.*; 134				*a*	*b*		*d*	
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viscosum, *R. Brown*; 5			E	*a*	*b*		*d*	*k*
deserti, *A. Cunn.*; 5	C	M		*a*		*c*	*d*	
parvifolium, *R. Brown*; 6	C	M	E	*a*	*b*	*c*	*d*	
brevipes, *Benth.*; 6	C							
platycarpum, *R. Brown*; 7	C	M		*a*	*b*		*d*	
Eremophila Dalyana, *F. M.*; 10	C							
scoparia, *F. M.*; 10	C	M		*a*	*b*			
Delisseri, *F. M.*; 11	C							
Weldii, *F. M.*; Frag. vii., 109	C							
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Behriana, *F. M.*; 12					*b*	*c*	*d*	*k*
Christophori, *F. M.*; Fg. ix., 120	C							
densifolia, *F. M.*; 13	C							*k*
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divaricata, *F. M.*; 14		M						
santalina, *F. M.*; 15				*a*				
rotundifolia, *F. M.*; 19	C							
oppositifolia, *R. Brown*; 20	C			*a*				
Paisleyi, *F. M.*; 20	C							
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polyclada, *F. M.*; 24	C							
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Duttoni, *F. M.*; 28	C							
maculata, *F. M.*; 29	C	M						
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alternifolia, *R. Brown*; 30	C	M		*a*				
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Styphelia humifusa, *Pers.*; 156		M	E	*a*	*b*	*c*	*d*	*k*
Sonderi, *F. M.*; 158	c	M	E			*c*		*k*
strigosa, *Smith*; 175						*c*		
Richei, *Labill.*; 186		M	E	*a*	*b*	*c*		*k*
australis, *F. M.*; 186			E			*c*		
collina, *Labill.*; 191			E					
concurva, *F. M.*; 198						*c*		
virgata, *Labill.*; 201		M				*c*		
ericoides, *Smith*; 200			E					
cordifolia, *F. M.*; 214	c	M		*a*	*b*	*c*	*d*	
hirtella, *F. M.*; 218						*c*		
rufa, *F. M.*; 220				*a*	*b*	*c*		*k*
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serrulata, *Labill.*; 227						*c*		
patula, *Spreng.*; 227					*b*	*c*	*d*	*k*
ovalifolia, *Spreng.*; 228		M	E		*b*		*d*	
depressa, *Spreng.*; 228		M				*c*		*k*
fasciculiflora, *F. M.*; 229						*c*		
Monotoca elliptica, *R. Brown*; 230			E					
Brachyloma ericoides, *Sond.*; 172		M				*c*		*k*
daphnoides, *Smith*; 173		M						
Epacris impressa, *Labill.*; 235		M	E			*c*		
obtusifolia, *Smith*; 237			E			*c*		
lanuginosa, *Labill.*; 238			E					
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Sprengelia incarnata, *Smith*; 249			E			*c*		
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Decaisneana, *F. M.*; 201	c							
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Cymbidium canaliculatum, *R. Brown*; 302	c							
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Thelymitra ixioides, *Sw.*; 317			E					
aristata, *Lind.*; 319			E			c		
longifolia, *Forster*; 319		M	E	*a*		c	d	
fusco-lutea, *R. Brown*; 321						c		
carnea, *R. Brown*; 321						c		
flexuosa, *Endl.*; 322			E			c		
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Diuris palustris, *Lind.*; 327		M		*a*		c	d	
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sulphurea, *R. Brown*; 330			E					
longifolia, *R. Brown*; 331			E			c		
Orthoceras strictum, *R. Brown*; 332					*b*	c		
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Lyperanthus nigricans, *R. Brown*; 374		M		*a*		*c*		
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cartilagineus, *Spreng.*; 328		M				*c*	*d*
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glomeratum, *R. Brown*; 404			E				
tetraquetrum, *Hooker*; 406						*c*	
Gunnii, *Hooker*; 407						*c*	
junceum, *R. Brown*; 408			E		*b*	*c*	
filum, *R. Brown*; 409						*c*	
lanigerum, *R. Brown*; 415					*b*	*c*	*d*
deustum, *R. Brown*; 416		M			*b*		*d*

Cladium psittacorum, *F. M.*; 418			E				
Carex inversa, *R. Brown*; 438			E			*c*	
chlorantha, *R. Brown*; 440			E				
paniculata, *Linné*; 440			E				
tereticaulis, *F. M.*; 441			E		*b*	*c*	
vulgaris, *Fries*; 442		M	E			*c*	
pumila, *Thunb.*; 445		M		*a*		*c*	
Gunniana, *Boott*; 446						*c*	
pseudocyperus, *Linné*; 448		M		*a*		*c*	
GRAMINEÆ (Fl. Aust., vol. VII.)							
Panicum cœnicolum, *F. M.*; 467	C			*a*			
divaricatissimum, *R. Brown*; 467	C	M					
leucophœum, *H. B. & K.*; 472	C			*a*			
gracile, *R. Brown*; 475	C	M		*a*		*c*	
Gilesii, *Benth.*; 477	C						
distachyum, *Linné*; 478	C						
reversum, *F. M.*; 478	C						
adspersum, *Trin.*; 481	C						
pauciflorum, *R. Brown*; 483	C						
effusum, *R. Brown*; 488	C		E	*a*		*c*	
decompositum, *R. Brown*; 489	C						
prolutum, *F. M.*; 490				*a*			
Setaria glauca, *Linné*; 492	C						
viridis, *Linné*; 494	C					[*c*]	
refracta, *F. M.*; 494	C						
Spinifex hirsutus, *Labill.*; 503	C	M	E		*b*	*c*	*d*
paradoxus, *R. Brown*; 504	C	M					
Lappago racemosa, *Willd.*; 506	C						
Neurachne alopecuroides, *R. Brown*; 507		M				*c*	*d*
Mitchelliana, *Nees*; 508		M					
Munroi, *F. M.*; 508		M					
Hemarthia compressa, *R. Brown*; 510						*c*	
Erianthus fulvus, *Kunth*; 526	C	M					
Andropogon sericeus, *R. Brown*; 529	C			*a*			
pertusus, *Willd.*; 530	C						
annulatus, *R. Brown*; 531	C			*a*			
intermedius, *Forst.*; 539				*a*			
laniger, *Desf.*; 533	C	M				*c*	
Gryllus, *Linné*; 537	C						
Imperata arundinacea, *Cyr.*; 536		M				*c*	
Anthistiria ciliata, *Linné*; 542	C	?	E		*b*	*c*	*d*
avenacea, *F. M.*; 543	C						
membranacea, *Lind.*; 543	C						
Ehrharta stipoides, *Labill.*; 552			E			*c*	
Aristidia stipoides, *R. Brown*; 561	C						
arenaria, *Gaud.*; 561	C	M		*a*			

Aristidia Behriana, *F. M.*; 562		M				*c*	*d*	
calycina, *R. Brown*; 563	C							
Stipa elegantissima, *Labill.*; 565	C	M		*a*	*b*	*c*	*d*	
flavescens, *Labill.*; 566					*b*	*c*		
crinita, *Gaud.*; 567	C						*d*	
setacea, *R. Brown*; 568		M		*a*				
semibarbata, *R. Brown*; 568		M	E				*d*	
pubescens, *R. Brown*; 569				*a*				
aristiglumis, *F. M.*; 570		M		*a*			*d*	
Pentapogon Billardieri, *R. Brown*; 572						*c*		
Dichelachne crinita, *J. Hooker*; 574						*c*	*d*	
Agrostis Solandri, *F. M.*; 579, &c.			E	*a*		*c*	*d*	
quadriseta, *R. Brown*; 581		M				*c*		
venusta, *Trin.*; 576			E					
scabra, *R. Brown*; 583			E					
montana, *R. Brown*; 581						*c*		
densa, *F. M.*; 582						*c*		
Deschampsia cæspitosa, *Linné*; 587			E					
Amphibromus Neesii, *Steud.*; 589				*a*		*c*		
Amphipogon strictus, *R. Brown*; 597	C	M		*a*		*c*	*d*	
Echinopogon ovatus, *G. Forst.*; 599						*c*		
Pappophorum commune, *F. M.*; 601	C	M		*a*	*b*	*c*		
Astrebla pectinata, *F. M.*; 602	C							
triticoides, *F. M.*; 602	C							
Triraphis mollis, *R. Brown*; 603	C	M						
Cynodon dactylon, *Pers.*; 609		M	[E			*c*]		
ciliaris, *Benth.*; 610	C							
convergens, *F. M.*; 610	C							
Chloris pectinata, *Benth.*; 612	C							
divaricata, *R. Brown*; 612	C							
acicularis, *Lind.*; 612	C	M	E			*c*		
truncata, *R. Brown*; 612			E			*c*		
barbata, *Sw.*; 613	C							
Eleusine cruciata, *Lamarck*; 615	C							
subdigitata, *F. M.*; 617	C							
Sporobolus virginicus, *Kunth*; 621			E	*a*	*b*	*c*	*d*	
var. pallida	C	M		*a*				
indicus, *R. Brown*; 622	C	M						
actinocladus, *F. M.*; 623	C							
Eriachne aristidea, *F. M.*; 629	C							
ovata, *Nees*; 630	C							
scleranthoides, *F. M.*; 631	C							
obtusa, *R. Brown*; 632	C							
Phragmites communis, *Trin.*; 636		M	E			*c*		
Roxburghi, *Kunth*	C			*a*	*b*			
Distichlis maritima, *Rafin.*; 637		M	E	*a*	*b*	*c*	*d*	*k*
Elytrophorus articulatus, *Beauv.*; 638	C	M						

Eragrostis tenella, *Beauv.*; 643	c						
trichophylla, *Benth.*; 644	c						
leptocarpa, *Benth.*; 644	c						
pilosa, *Beauv.*; 645		M					
diandra, *R. Brown*; 646						*c*	
concinna, *Steud.*; 647	c						
speciosa, *Steud.*; 648	c						
laniflora, *Benth.*; 648	c						
chætophylla, *Steud.*; 648	c	M		*a*			
lacunaria, *F. M.*; 649	c	M					
falcata, *Gaud.*; 649	c	M					
Poa cæspitosa, *G. Forst.*; 651			E				*d*
nodosa, *Nees*; 653		M		*a*		*c*	
lepida, *F. M.*; 654			E	*a*	*b*		*d*
Fordeana, *F. M.*; 657		M					
fluitans, *Linné, sp.*; 657			E			*c*	
syrtica, *F. M.*; 658				*a*	*b*	*c*	
ramigera, *F. M.*; 659		M					
Schedonorus littoralis, *Beauv.*; 655		M					
Bromus arenarius, *Labill.*; 661	c			*a*		*c*	*d*
Festuca fusca, *Linné*; 619	c	M					
loliiformis, *F. M.*; 618	c						
Triodia pungens, *R. Brown*; 606	c						
irritans, *R. Brown*; 607	c	M		*a*		*c*	*d*
Diplachne Muelleri, *Benth.*; 619	c						
Danthonia penicillata, *F. M.*; 592	c		E			*e*	*d*
Agropyrum scabrum, *Beauv.*; 665			E			*c*	*d*
Lepturus cylindricus, *Trin.*; 668						*c*	
incurvatus, *Trin.*; 663		M				*c*	*d*
ACOTYLEDONEÆ.							
LYCOPODIACEÆ (Fl. Aust., vol. VII.)							
Lycopodium densum, *Labill.*; 676						*c*	
Selaginella Preissiana, *Spring*; 677			E				
uliginosa, *Spring*; 678			E				
Azolla pinnata, *R. Brown*; 679		M					
filiculoides, *Lamarck*; 680		M	E				
MARSILEACEÆ (Fl. Aust., vol. VII.)							
Marsilea quadrifolia, *Linné*; 683	c		E				
FILICES (Fl. Aust., vol. VII.)							
Ophioglossum vulgatum, *Linné*; 688						*c*	*d*
Schizæa bifida, *Swartz*; 693			E				
Gleichenia circinata, *Swartz*; 697						*c*	

Todea barbara, *T. Moore*; 699							*c*		
Dicksonia antarctica, *Labill.*; 712			E				*c*		
Lindsæa linearis, *Swartz*; 719			E				*c*		
Adiantum æthiopicum, *Linné*; 724			E				*c*		*k*
hispidulum, *Swartz*; 725			E						
Cheilanthes tenuifolia, *Swartz*; 726	C		E				*c*	*d*	
vellea, *F. M.*; 773	C								
distans, *A. Braun*; 774	C			*a*	*b*		*c*	*d*	
Pteris aquilina, *Linné*; 732			E				*c*		*k*
incisa, *Thunb.*; 732			E						
Lomaria discolor, *Willd.*; 735							*c*		
lanceolata, *Spreng.*; 735			E						
capensis, *Willd.*; 737							*c*		
Asplenium flabellifolium, *Cav.*; 745			E				*c*		
furcatum, *Thunb.*; 747			E						
bulbiferum, *Forst.*; 748			E						
Aspidium molle, *Swartz*; 756		M							
decompositum, *Spreng.*; 758			E						
Polypodium punctatum, *Thunb.*; 764			E						
Grammitis Reynoldsi, *F. M.*; 775	C								
rutæfolia, *R. Brown*; 775	C	M					*c*	*d*	
leptophylla, *Swartz*; 776							*c*		

SUPPLEMENTAL LIST OF SPECIES.

CRUCIFERÆ.									
Barbarea vulgaris, *R. Brown*; 66							*c*		
CAPPARIDEÆ.									
Capparis spinosa, *Linné*; 94 (nummularia)	C								
CARYOPHYLLEÆ.									
Drymaria filiformis, *Benth.*; 162								*d*	
EUPHORBIACEÆ.									
Phyllanthus rhytidospermus, *F. M.*; 100	C								
SAPINDACEÆ.									
Dodonæa lanceolata, *F. M.*; 475	C								
Tepperi, *F. M. (m.s.)*								*d*	
CHENOPODIACEÆ.									
Kochia humillima, *F. M.*; Frag. ix., 168								*d*	
FICOIDEÆ.									
Trianthema humillima, *F. M.*; Frag. x., 73								*d*	

UMBELLIFERÆ.								
Hydrocotyle rugulosa, *Turcz.*; 344								*d*
LEGUMINOSÆ.								
Crotalaria medicaginea, *Willd.*; 183	c							
Indigofera linifolia, *Retz.*; 195	c							
Tephrosia purpurea, *Pers.*; 209	c							
Rhynchosia minima, *De Cand.*; 267	c							

N.B.—The total number of species contained in the foregoing lists is 1,599.

ADDENDA TO GEOGRAPHICAL COLUMNS.

Region M. *Clematis microphylla; Hibbertia densiflora, H. acicularis; Drosera glanduligera, D. Whittakeri; Poranthera microphylla; Adriana quadripartita; Geranium dissectum; Pelargonium australe; Zygophyllum ammophilum; Swainsona lessertiifolia; Kennedya prostrata; Alchemilla arvensis; Tillæa verticillaris; Callitriche verna; Cotula australis; Gnaphalium Japonicum; Stuartina Muelleri; Myoporum viscosum*; *Marsilea quadrifolia.*

Region C. *Abutilon Fraseri; Claytonia corrigiolacea; Chenolea paradoxa.*

Region S *c. Hibbertia acicularis.*

Region S *d. Geococcus pusillus*; *Eucalyptus dumosa; Claytonia pygmæa; Stylidium calcaratum; Centrolepis aristata;* and 16 others, for which see Mr. Tepper's Supplement to Plants about Ardrossan.

The figures in the tables on pages 49 and 50 are no longer correct; but as the deductions based upon them are not materially affected by the new reading, a revision of them is deferred to a future occasion. In the meanwhile, the compiler solicits the assistance of all botanists to make the geographical lists as complete as possible.

ERRATA

p. 54, line 21, for trachspermus read trachyspermus.
line 25, for *Sand.* read *Gaud.*
p. 71, line 10, for 540 read 549.

The "Bay of Biscay" Soil

of South Australia, and its Formation.

By Otto Tepper, F.L.S., Corr. Member.

[Read June 1, 1880.]

INTRODUCTORY CITATION.

"I may remark in connection with the clays overlying the Miocene limestone that it is on their surfaces that the 'Bay of Biscay' land prevails. This name is applied to tracts covered with mounds or ridges grouped in the most irregular way, and without any relation to the natural slope of the surface. The ridges, which rarely exceed a foot in height, are composed of clay, while the depressions are occupied by alluvium or sandy loam; and though it is generally held that the soil of the depressions extend in depth, yet my observations are totally opposed to that view. How the depressions have been formed on the clay soil, and how they have been partially filled, are questions which, I hope, will occupy the attention of some member of this Society."—Prof. R. Tate, F.G.S.; President's Anniversary Address Trans. A. Phil. Soc., 1878-9, page lx.

In many parts of South Australia a clayey soil occurs, which is popularly called by the above name, and is justly regarded by most people as one of the most productive. Among other localities we meet it in the undulating Tertiary regions north of Gawler, in the neighbourhood of Tanunda, Greenock, Sheaoak Log, Freeling (villages north of Adelaide), and extending far beyond Kapunda. Again, the same soil is found in small patches near Ardrossan, Yorke's Peninsula. Maitland, in the centre of the same peninsula, is surrounded by it, from whence it stretches into the neighbouring hundreds. In fact, it is found to a greater or less extent in many counties, but the above localities have been examined by me.

Its most characteristic feature is the unevenness of its surface, forming shallow round depressions 6 to 18 inches in depth, and without an outlet. These are surrounded by elevations of varying width, sometimes forming almost ridges, at others equalling or exceeding the depressions in area. The sides are never steep; but frequently one incline is longer than the other, then the shorter one is also the steeper. We meet this surface formation on the broad gently-rounded summit of hills, as well as on almost level gradually rising plains, bounded

on two or three sides by lower ground; and sometimes on the inclines of the hills.

Under the last-mentioned circumstances the said inclines are either very gradual or in terraces. As long as the ground remains in its pristine state, very few or no watercourse are distinguishable; those found are very wide, shallow, and carry very little water. But as soon as the continuity of the turf, noted for its luxuriance, is broken by the farmer's plough, the traveller's dray, or an exceptionally heavy thunderstorm, the bed rapidly deepens, on account of the peculiar nature of the soil, and in a short time assumes respectable dimensions, specially remarkable for the steepness of its banks. If not carefully attended to, the denudation proceeds at so rapid a rate that perhaps in less than a century the whole surface of these regions would, for a considerable depth, be carried out to sea. The cause of this lies in the constitution of the soil. It consists of a dark-red or brown clay, containing much lime and a little fine gravel. Some portions are almost black, other patches grey or bluish. The former occupy generally a part of the elevation and inner slope, sometimes the lowest part also; the latter the remaining part of the slope, generally that facing the higher level of the whole area. However, even where the differences in colour are less marked, a newly-ploughed field of virgin soil of this description presents, when viewed from some distance, always a curious irregularly mottled appearance.

When dry the whole surface is scored in every direction by numerous cracks, often from one to two inches wide, and extending to a considerable depth. The light-coloured patches are much less affected than the darker, but all are rendered in proportion more or less friable and yielding to a most fatiguing extent for weary travellers, &c., and in a very short time the feet of animals and the wheels of vehicles triturate it into incredibly minute particles, forming clouds of dust. If a heavy shower of rain fall for an hour or two the whole surface is changed into an exceedingly adhesive mire, heavily clogging feet and wheels with tough pug. Owing to the uneven surface the water is detained, and a large quantity at once percolates through the larger and smaller cracks, carrying with it a considerable moiety of the loose soil to some depth, and widening the channel in the descent. In the narrower portions of the latter, grass leaves, stray pebbles, &c., will be arrested, and will prevent the closing of the fissure, when the clay expands on saturation, and will facilitate its reopening when the clay shrinks on drying. Actual repeated observations seem to demonstrate that at least the larger of these fissures *do* open year after year, and are productive at times of rather practical annoyances. Thus a large crack through

two opposite walls eighteen inches thick in a house of an acquaintance opens out wide every summer and contracts closely every winter. Some large cracks had been observed in the ground before building but were regarded as superficial merely. Whence do these fissures lead? Direct observations prove that these adhesive clays are succeeded by layers of limestone concretions, gravel beds, decaying calcareous slates, &c. As all these are very porous, they afford easy channels for the drainage of the surface waters and the materials carried in a comminuted state by the same, and thus surface watercourses are rendered unnecessary. If this process be frequently repeated, as is no doubt the case every year, it follows that the friable, fertile soil around the vents must gradually diminish, and shallow depressions be formed in the course of time, slower or faster, as local circumstances favour. Only one instance remarkable for rapidity of effect can be cited. In a "Bay of Biscay soil" region, on a somewhat steep slope descending from New Mecklenburg plain towards the River North Para, west of Tanunda, a hole was noticed in the ground after a heavy rain; its diameter was about three inches, the depth rather more, the sides steep. A small rill of flood-water escaped into it, without overflowing in the direction of the steep banks of a brooklet some 20 or 30 yards distant. This insignificant vent gradually widened, and in less than two years had augmented to three feet in depth, and over four feet diameter.

The conclusions deduced from the foregoing are:—(1) If the subterranean vents be relatively few, the depressions will be correspondingly apart; (2) the longer the time has been during which operations as described have been carried on, the narrower will be the ridges between the depressions; (3) the more friable the soil the steeper will be the slopes; (4) if the fissures be very small, numerous, and equally distributed, assuming uniform porosity of the subsoil also, none or very shallow depressions will be formed, because every part of the area will be reduced simultaneously at the same rate nearly. Thus the depth and distribution of the depressions depend on inequality of distribution and size of the temporary fissures, the friability of the soil, the porosity of the subsoil, and time.

If the nature of the soil is such as to admit of very rapid expansion, and consequent long detention of the muddy waters, a fine sediment will collect in the bottom, which, *drying hard* when exposed, will at last prevent any deep fissures from forming, and thus constitute what in colonial parlance are termed "claypans"—a blessing for all regions destitute of permanent springs. Some of these are scattered in

the dense mallee scrub between Ardrossan, Yorke Valley, and Kalkabury upon gently inclined flats, and their immediate neighbourhood is at once made manifest by a distinct vegetation, including *Eucalyptus incrassata*, *Callcstemon coccineus*, *Juncus pallidus*, and *J. bufonius*, &c., which depend on the greater moisture there obtainable. In a similar manner even lakelets of some extent may be formed anew by the closing or chocking up of the subterranean vents for draining off the rainwater. Thus since about 1852, an almost permanent sheet of water has covered an area of some 120 acres at Hoffnungsthal, near Lyndoch, which had been farmed for several years and produced some splendid crops of wheat. The soil consisted of deep black loam—friable when dry, stiff and adhesive when wet. Under this a yellow arenaceous clay followed, becoming more and more gravelly at increased depths, till at sixteen to twenty feet brackish water stopped further sinking. This basin, inclosed on three sides by high hills of micaceous slates, hornblende schists, quartzites, &c., and at the fourth by a small rising plain, through which at a distance of about a mile a brook flowed, whose bed was at a higher level than that of the basin, had been overgrown with grass and numerous eucalypts, and never observed to contain stagnant water while in its natural state. The drainage received from a considerable area for the locality no doubt then escaped by numerous underground channels, which were choked when the farmers' plough broke the turf and produced more sediment than could be carried along. The first inundation lasted some three months only, when the ground became sufficiently dry for another crop, which grew most luxuriantly, till in the succeeding August it was overwhelmed again by the water in augmented quantity. But only the third year beheld its permanency, the water henceforth being only removed by evaporation. This fact, together with the death of the trees after the first flood, proves the *gradual* closing of the underground outlets (caused by the stirring of the soil), and thereby the correctness of the theory. Some people believed that the opening of the subterranean springs (according to the popular but fallacious idea that tillage, &c., facilitates their increase) was the cause, but this would demand complicated phenomena, the occurrence of which to assume is not warranted in the slightest degree by the surrounding country. It is to be mentioned that out of six or seven wells sunk around the margin only two contained fresh water, the rest so brackish as scarcely to be fit for cattle. The flood water was at first quite fresh, but in the course of years assumed a more and more saline character, and now the whole has the general aspect of an ordinary salt lagoon. The above naturally suggests that this and similar other areas in

great number, containing rich black soil, but vitiated by the accumulation of salts, might frequently be reclaimed under proper scientific guidance (and with small expense considering the value of such lands), but of this our paternal colonial Government is still very impatient, trusting rather to amateurs, who call themselves "practical."

Returning after this digression touching the origin of clay-pans and salt lagoons to the "Bay of Biscay" soil it will be noted that an attempt has been made to show and prove that its peculiar surface configuration is due to denudation, *vertically downwards*, the lateral motion of the waters being retarded or prevented altogether (temporarily, at least) by the nature of the soil; and, it is hoped, this task has been accomplished satisfactorily.

The question now arises, Where and how has this peculiar soil been formed originally? and to which geological period does it appertain?

Replying to this latter question first, for the sake of convenience, this soil seems to belong, in the areas examined at least, chiefly to the Tertiary and Post-Tertiaries, extending to the most recent near the sea-coast.

Whether the former was formed by ice action or atmospheric influences, so much seems sure to an observer of the littoral mudbanks and salt marshes around the head of St. Vincent's Gulf that originally the "Bay of Biscay" soil must have originated in a similar manner and under similar circumstances —that is to say, that in the writer's opinion the present "Bay of Biscay" lands were the mudflats and marshes of former periods. The extensive lowlands around the head of St. Vincent's Gulf, in the neighbourhood of Port Wakefield, the recent marine origin of which is undoubted, afford a good illustration, and may be called growing "Bay of Biscay" lands, the great unevenness of the former being the exaggerated unfinished form of the latter.

Studying localities like the above we find that, while slowly rising above the sea-level, irregular low ridges are formed through exceptionally high tides by deposits of seaweeds, sand, mud, &c., enclosing depressions of various dimensions, frequently retaining part of the flood-waters. When permanently established, these depressions, for some time, gradually are filled up by the dense growth and decay of plants like *Salicornia arbuscula*, the blowing in of sands, dust, weeds, &c., and the inward pressure of the denser ridges. The shells decay, their lime is dissolved and removed by the water, charged with carbonic acid, obtained from decaying vegetable remains. The soil only admitting the downward motion of the water to a certain depth, part of the lime is reprecipitated as tabular or

globular concretions. Augmenting through long period, these layers consolidate to a greater or less extent, and give consistency to the subsoil. When examined, they always show their upper portion to be the hardest and firmest, presenting some openings of variable size at irregular distances, through which the surface drainage alone can escape. These openings, collecting the waters and thereby facilitating the formation of subterranean channels, will be found to be where the percolation of the water is most abundant—*i.e.*, below the depressions; but also elsewhere, if the former be far apart, as other circumstances favour the escape of surface water, and wherever such exist, there in the course of time a hollow will be formed by the gradual removal of part of the soil directly above the place. Thus we come to the same conclusions as those arrived at from a different starting point.

The generally black colour of the soil in these mud-flats is caused by the carbon of decaying organisms and imperfectly oxygenised iron, as proved when exposed to red heat. Both ingredients change simultaneously through the chemical action of the water. The iron taking up more oxygen assumes the characteristic colour, and imparts it to the soil; the carbon is turned into carbonic acid and removed. The latter occurs most rapidly in the depressions. The acidulated water removes a part—or the whole, in small patches—of the iron oxide, redepositing it at lower levels, viz., among buried sands and gravels, cementing them into ferruginous sandstones and conglomerates (assisted, no doubt, by soluble silicates obtained from the same sources), or forming beds or patches of loose lapilli-like concretions with polished exterior surface, sometimes exploding with a tiny crash when thrown in the fire. Operations like the foregoing when acting through long periods may be safely assumed as quite capable to produce all the results in changing the surface aspect of large areas as described, and although one cannot watch them at any one place, yet their respective stages can be observed at different localities. According to this the black portions of the "Bay of Biscay" soil are considered to be due to some unremoved carbon, &c.; the reddish parts to ferric oxide; the light-coloured parts either to the entire absence of either, or the superabundance of lime; both causes render them less suited for vegetable growth till supplied with mould from the neighbouring more productive regions.

If downward denudation be very rapid, as in some parts of the coast plain near Ardrossan, even the greater part of the clay may have disappeared from the ridges, and only some mixed with mould be left in the depressions. In this case the former will be the more barren portions, consisting of smal

limestone concretions, sandy clay, &c., and besides obtain less moisture, the water being collected and retained by the hollows. These, therefore, exhibit a denser growth of grass and herbs, and consequently an accumulation of mould.

To account for the different inclinations which the "Bay of Biscay" soil shows, an unequal, but else regular, elevation of the whole area is required; but the various inclines may also have been produced by differential denudation, the latter being more rapidly carried on where the soil operated on was thickest, and thus the valleys scooped out between the hills; on the sides of the hills a part of the soil was left, which originally occupied different levels.

In proof of the theory advanced as to the origin of this peculiar soil, a few observations will be cited. In the neighbourhood of "Bay of Biscay" regions extensive patches of fine white sand are found, generally overgrown by dense scrub; but occasionally holes are found blown out by wind, in which are left all heavier ingredients. Amongst these the writer has sometimes found fragments of large shells. Being 30 to 40 miles from the next sea-shore, their carriage thence by human agency is, at least, very improbable. Whether these sands be assigned to a marine or lacustrine origin is immaterial, as that would not affect the final result. Underlying these sands and the "Bay of Biscay" clays, are frequently found thin layers of ferruginous sandstones and conglomerates, destitute of fossils (except some cavities resembling those left by the removal of large shells or echinids, and some fossilized wood), fringing the respective regions to a great extent, they are found neither to retain the same direction (part denudation), nor the same level (inequality of elevation); never of great vertical thickness, they are penetrated by numerous perpendicular smooth fissures, partly filled with fine oxide of iron and small round holes, through which the rainwater penetrates to the underlying beds. The latter consist of gravels and sand, in some places that were examined; in others of an arenaceous clay strongly impregnated by saline substances, impure salt forming numerous small veins and nests therein. Below these again purplish ferruginous shales of a peculiar wavy structure follow invariably where examined near Nuriootpa, Tanunda, and Greenock.

The latter observations were first made by the writer in 1876-7, and if the saline clays should prove a general feature in connection with the "Bay of Biscay" soil, their discovery would reveal the cause why wells in such regions always produce salt-water. The whole series rests unconformable upon palæozoic rocks of pre-silurian age.

Having first shown, by assuming an originally level surface, that the physical properties of this soil admitted and necessitated

its present surface configuration, through the operation of simple natural causes, and then referred to the forming of the soil as a marine or lacustrine sediment in sheltered and gradually rising localities, and followed the various changes to some extent, with some proofs that the requisite products really do exist where to be expected—it is hoped that the foregoing pages may prove sufficient as a basis (temporary, at least) whereon to ground a more perfect explanation after extended observations by abler minds.

ON SOME

New Corals from the Australian Tertiaries.

By the Rev. J. E. Tenison Woods, F.G.S., F.L.S., President of Lin. Soc., N.S.W.; Hon. Member.

[Read July 6, 1880.]

I propose to describe in this paper three new fossil corals. The first two were sent to me by Professor Tate, and are those referred to by him in his paper on the "Natural History of the Country around the Head of the Great Australian Bight" (Trans. Phil. Soc., Adelaide, 1879), at p. 107, in the following terms:—"Mr. J. Clark, telegraph-master at Eucla, has presented to me a few fossils and stones picked up by him on the surface [of the Bunda Plateau] at Fairlie's last camp, 80 miles N.N.E. from Eucla. The fossils* are undoubtedly older Tertiary, and though their tests are calcedonized and deeply stained with oxide of iron, yet as the matrix is a yellow crystalline limestone, I would refer them to the horizon of the upper bed of the Bunda Cliffs." This deposit he correlates with the upper set of fossiliferous beds of the R. Murray Cliffs, and with the Muddy Creek Miocene strata.

It will be seen from the following remarks that both the species are decidedly tropical in aspect. One belongs to a genus which is only known in the tropics; and whilst the other has representatives in the temperate seas of Australia, yet none of the existing species are of such a large size, and none of the forms peculiar to the temperate seas are in any way similar. These fossils form another link in the chain of evidence as to the semi-tropical character of the fauna of our Tertiary seas. They are certainly to be ranked as amongst the most interesting discoveries made, though the whole of our radiate Tertiary fauna is replete with features of interest and novelty.

In the section of tabular Madreporaria there are four families—two with great development of cœnenchyma (Milleporidæ and Seriatoporidæ) and two with little or none (Favositidæ and Thecidæ). The Milleporidæ have a tabular foliaceous or massive cœnenchyma, and the Seriatoporidæ have the same structure compact; there are four genera in the latter:—

* The species are—*Cerithium Nullarboricum*, Tate; *Plesiastræa*, sp., and *Seriatopora*, sp.

Dendropora—Cœnenchyma smooth, calices scattered.

Trachypora—Cœnenchyma vermiculate.

Rhabdopora—Cœnenchyma finely hispid, calices serial, septa very distinct.

Seriatopora—Septa scarcely visible.

The genus *Seriatopora* is thus defined—*Corallum* aborescent; *cœnenchyma* finely hispid; *calices* disposed in an ascending series; *columella* large, compact, and placed in the direction of the axis of the branches; *visceral chambers* obliterated completely in the course of growth.

It is doubtful whether there are ten species in all of this genus, but it is one of the most common on all the barrier reefs of Australia; and probably *Seriatopora subulata* is the most extensively distributed throughout the Pacific and Australian seas. There are no fossil forms known to me, unless those which may occur in the raised beaches on the coast of Java. The discovery of the present fossil (herein described as *Seriatopora antiqua*) in the Australian Tertiaries is a fact of great interest, especially as it has been found in a latitude far outside where any reef-building corals exist now.

Seriatopora antiqua, *spec. nov.*

The fragment is evidently a portion of a broad, compressed, and coalescent branch, resulting from the union of smaller ones, as in *S. subulata*. The branches are hollow. The *cœnenchyma* is very hard and compact, and shows no traces of structure where broken; it is much worn, but here and there exhibits traces of its hispid character in numerous worn granules. *Calices* about one millimetre in diameter, very close, surrounded by a raised ring, rather deep. *Columella* of the form of a large rounded tubercle, much higher than the septa, which are six in number, visible, but not conspicuously so.

The fragment is 25 millimetres long, ten thick, and fifteen wide; but there are also projections like the terminations of branches.

In the size of the calices and the distinctness of the septa, the species resembles *Seriatopora spinosa*, Ehrenberg, which is found in the Red Sea.

Plesiastræa grandis, *spec. nov.*

Corallum a much-worn fragment, about 65 millimetres high, 75 wide, and from 20 to 25 thick. The fragment is broken, so as to expose the plan of the calices and every kind of section. *Corallites* evidently radiating in a convex manner from a central disc; they are long, closely packed, and united by a

very abundant exotheca. *Calices* circular; *septa* in four cycles, three of which are of equal length. There are no calices sufficiently perfect to show the pali; but in section the septa are all much thickened close to the columella, which seems to have been compact. *Endotheca* very abundant, curved upwards from the columella, and showing eight or ten transverse partitions to each of the loculi. *Costæ* continuous with the septa, those belonging to the first cycle being very long, and showing no break at the wall, but passing through it into the septa. Sometimes, though rarely, the costæ are confluent with the costæ of the neighbouring calice, but in this case there is always a thin lamina of epitheca, which forms in section a secondary wall. The internal edges of the septa appear to have been dentate. The endotheca and exotheca are about equally abundant, and the fourth cycle of septa is rudimentary in some of the systems, and very small in all.

Diameter of calices, seven to eight millimetres.

I have already described one fossil species of *Plesiastræa*, *P. St. Vincenti* (Trans. Phil. Soc., Adelaide, 1878, p. 116), but it is much smaller than this species. The genus may be said to be almost an Australian one, and the discovery of two fossil species entitle it still more to this character. The present species is quite tropical in aspect, and would form reefs. It is unusually hard and compact in texture, and, like the fossil previously described, it is very ferruginous, which is not the case with *P. St. Vincenti*. The details are not very satisfactorily seen, but other specimens will doubtless be discovered in the course of time.

Microtrochus minutus, *spec. nov.*; Pl. iv., figs. 3*a*—3*b*.

The third species of coral here to be noticed is a minute fossil adhering to the base of a *Lunulite* from the Miocene beds of Muddy Creek. It probably belongs to the second or epithecated division of Trochosmiliaceæ, but being in a young state not anything very definite about its position can be stated, though I do not think it belongs to any described.

Corallum minute, not a millimetre in height, attached by one side to the base of *Lunulites cupola*, mihi; rather higher than broad. Side with six distinct costæ, which are larger towards the end. About half way up they are concealed by concentric layers of rugose epitheca, through which the costæ are faintly visible. *Calice* nearly circular, uneven at the edge. *Septa* twelve in number, undulating, sparsely spinous, finely granular, with toothed uneven edges. *Columella* represented by three or four twisted processes, which are joined to the septa. *Endotheca* doubtful, but apparently existing between some of the lower septa.

DESCRIPTIONS OF SOME

NEW SPECIES OF SOUTH AUSTRALIAN PULMONIFERA.

By PROFESSOR RALPH TATE, A.L.S., F.G.S., &c., President.

[Read July 6, 1880.]

Ancylus Australicus, *spec. nov.* Plate iv., figs. 4*a*—4*b*.

Shell pale, thin, and delicate; conic depressed, lengthened; sides subrectilinear or slightly convex, diverging slightly forwards. Apex blunt post-median, with about two-fifths the shell behind it, inclining backwards, and directed towards the right; the line from the apex to posterior border slightly concave, to the anterior border almost rectilinear. Peritreme oval, distinctly narrowed posteriorly.

Dimensions of a moderately large example; length, one-sixth of an inch; breadth, one-tenth of an inch; height, one-seventeenth of an inch, the respective dimensions being in the ratio of 100, 60, and 35.

The newly-formed shell is of a pale horn colour, but older parts have a reddish to blackish-brown coloured epidermis. The anterior portion of the cone is ornamented with strong concentric folds.

The *foot* of the animal is translucent, white, and is obtusely rounded behind. The tentacles are translucent, white, triangular, and subcompressed at the base, but are cylindrical in the upper part, ending in a blunt tip. The eyes are black, and in front of and slightly interior to the bases of the tentacles. The muzzle is emarginate, when extended. Only the tips of the tentacles are visible from beneath the shell when the animal is gliding.

Habitat and Station.—This species was first made known to me by Mr. Stirling Smeaton, B.A., who collected one example in a stream at Lyndoch Valley. I have since found it on the under side of the floating leaves of *Triglochin procera* in the Reedbeds; and abundantly in the River Torrens at Adelaide, on the under side of stones and on the submerged leaves of aquatic plants. Mr. Bednall informs me that he collected it in 1876 in the Brownhill and Waterfall Gully Creeks.

Affinities and Differences.—The apex of the shell of *Ancylus Australicus* having a decided inclination to right, the shell is sinistral, and, therefore, belongs to the genus *Ancylus*, and not to *Velletia*. The present species is the first, so far as I am aware, that has been recorded from this continent; though no less than three species have been described from Tasmania. Of these, *A. Cumingianus*, Bourg., has no congener; *A. Tasmanicus*, T. Woods, is separable from our shell by its proportionately greater height, and by its posterior apex; *A. Woodsii*, Johnston, comes much nearer to it. A comparison of specimens of the two species shows that *A. Australicus* differs in the following chief particulars from *A. Woodsii*—It is of a much larger size, is relatively more elevated and broader, and the apex is excentric.

Limnæa subaquatilis, *spec. nov.* Plate iv., figs. 6*a*—6*b*.

Shell thin, fragile, shining horn coloured; ovate subventricose whorls four longitudinally, but faintly wrinkled. Spire short, pointed; suture impressed. Aperture large ovate, half the length of the shell. Columella fold thin, opaque white, and reflected.

Dimensions.—Total length, seven-twentieths of an inch; length of spire, two-twentieths of an inch; length of aperture, five-twentieths of an inch; breadth, three-twentieths of an inch.

Habitat.—Among paludinal herbage growing on the marshy margins of the River Torrens at Adelaide.

This new species is allied to the Tasmanian *L. Huonensis*, T. Woods, but the last whorl is relatively narrower, and in consequence the revolution of the whorls is less oblique. But a species from the same island sent to me by Mr. Petterd, with the manuscript name of *Succinea Johnstoni* comes very near to our shell, if it be not identical with it; however, the Tasmanian specimens, which I have examined, are all young examples, and it becomes difficult to give distinctive characters; nevertheless, in them the spire is more exsert, and the last whorl is slightly flattened at the suture. Mr. Petterd informs me that his *S. Johnstoni* lives among wet moss, a habitat not so dissimilar from that in which *L. subaquatilis* has been found.

Limnæa papyracea, *spec. nov.* Plate iv., figs. 5*a*—5*c*.

Shell oblong ovate, very thin, smooth and shining, pale horn-coloured; wrinkled transversely. Spire rather short, whorls half-rounded at the sutures, last whorl ovate-oblong anteriorly sub-expanded, outer lip sinuously produced about the middle. Columella fold slender, slightly tortuous; inner lip widely and thinly spread. Figs. 5*a* and 5*b* represent a large specimen

selected as a type; figs. 5*c* are those of a varietal form in which the last whorl is more abrupt at the suture and shows a tendency to embrace the spire.

Dimensions of type specimen.—Total length, ·475; length of spire, ·175; breadth, ·275; length of aperture, ·4; greatest breadth, ·2 inch.

Locality.—Numerous dead shells from the bed of a dried up marsh near Penola, South Australia.

Bulimus Myoporinæ, *spec. nov.*

Syn. B. sinistrorsus, *Tate*, Trans. Phil. Soc., Adelaide, p. 134, t. 5, fig. 4.

The change in the specific name is necessary because Deshayes described many years ago a New Caledonian shell under the name of *B. sinistrorsus*. The name, here substituted, has reference to the habitat of the snail, that of living under the shelter of *Myoporum parvifolium*.

DESCRIPTION OF A NEW SPECIES OF BELEMNITE FROM THE MESOZOIC STRATA OF CENTRAL AUSTRALIA.

By Professor Ralph Tate, A.L.S., F.G.S., &c., President.

[Read July 6, 1880.]

Belemnites Canhami, *spec. nov.* Plate iv., figs. 2*a*—2*c*.

Guard hastate, terminating in an acute, sub-mucronate, central point; contracted in the medio-alveolar region; compressed ventro-dorsally, the ratio of the two diameters measured at a little further back than at the alveolar apex is as 2 to 3.

Each dorso-lateral face presents, through the whole length of the alveolar region, a deep and sharply cut furrow. In the region of the alveolar apex it makes an abrupt turn on to the medial line of the side of the guard, then splits into two shallow grooves, separated by a uniform distance about equal to their own width, which are continued to the apex.

The *Phragmacone* is sub-oblong in its transverse section, the dorso-ventral diameter is to the other in the proportion of 11 to 13. The *siphuncle* is subinternal, and the axis of the phragmacone is nearly straight.

The *length* of the guard is four inches; the greatest diameter is $\frac{9}{10}$ths, and the corresponding shortest diameter is $\frac{6}{10}$ths of an inch; the axis of the guard is $2\frac{1}{2}$ inches.

Explanation of Figures.

2*a*. Lateral aspect, showing the lateral groove with its flexure and bifurcation.

2*b*. Dorsal aspect, showing lateral furrows.

2*c*. Transverse section of alveolus, showing the unsymmetrical position of the dorso-lateral furrows, and the thin test on the ventral side; *s*, the siphuncle.

Affinities and Remarks.—This Belemnite is related to *B. australis*, Phillips (Quart. Journ. Geol. Soc., London, vol. xxvi., p. 258, t. xvi., figs. 1 and 2), but differs from it in being more distinctly hastate, much more compressed, and in the lateral grooves being continued into a double sulcus. Phillips seems to me to have included two, if not three, species under *B. australis;* and, judging from the remarks of the author and the drawings, the form represented by figs. 3 and 4 cannot be far removed, if separable, from *B. Canhami*. Dr. Hector has, in my opinion, misinterpreted the characters of *B. australis*, when he applies that designation to a species from the cretaceous rocks of New Zealand. (Trans. New Zealand Institute).

The number of specimens of *B. Canhami* examined by me is sixteen; these include examples ranging from $1\frac{3}{4}$ up to 4 inches in length. All exhibit such unmistakable community of characters, which cannot be said of the forms collected under the name of *B. australis*, that I cannot doubt that a good species, distinct from the typical *B. australis* (figs. 1 and 2, op. cit.), is represented by them.

Locality and Horizon.—Mesozoic beds near Peake, Central Australia. Forwarded by Mr. J. Canham, Corr. Memb., to whom the species is dedicated in recognition of his aid in advancing our knowledge of the Natural History of this province. Mr. Chandler, of Peake, writes me "that the specimens you have, were got from the Woodduck Creek, and none have as yet been found in conjunction with fossiliferous rock." The rock here referred to is one yielding *Monotis Barklyi, Cytherea Clarkei*, &c.

A second species of Belemnites (incorrectly referred by me to *B. australis, vide* Trans. Phil. Soc., p. l., 1879,) occurs in association with the fore-mentioned lamellibranchs at Mount Margaret, as proved by the collections made there by Mr. R. Beetson. The few specimens to hand are too much weathered for specific determination.

The Geology of the Hundred of Munno Para.

PART II.—THE UPLAND MIOCENE AND FUNDAMENTAL ROCKS AND ECONOMICS.

By Gavin Scoular, Corresponding Member.

[Read August 3, 1880.]

Plates v.—vi.

Contents:

1. Introduction and Surface Configuration.
2. Upland Miocene:—Description of Strata; Range; Vegetation upon; Water-bearing properties; Origin; Relation to Auriferous Cements.
3. Fundamental Rocks:—
   Supposed age.
   Geological structure, extent, and surface characteristics.
   Quartzites—description, distribution, and origin of.
   Clay Slate; Metamorphosed limestone.
4. Economics:—Mineral deposits; building materials and road metal.
   Springs issuing from Fundamental Rocks; Soils and vegetation.

Introductory Remarks.—Having in the former part of this paper carried a description of the geology of the district down to the beginning of the *Drift* period, I will now endeavour to occupy your attention with a description of the older rocks. Following the same plan, I shall in the first place treat of the Miocenes or Upland Tertiaries; afterwards the Fundamental Rocks, and conclude with a short outline of the economic geology and of the soils of the various rocks.

Form of the Ground Occupied by the Older Strata.—A glance at the map and longitudinal section will show that the quartzite series on the east and west occupy high ground, and enclose a longitudinal depression north and south constituted of clay-slate and thin limestones, which have yielded to a larger degree to atmospheric and aqueous action than the quartzites have done. It will further be seen that the direction of the channels of Tenafeat Creek and the South Para River, after receiving the water of that tributary, have been determined pretty much, if not wholly, by the trend and northly termination of the Munno Para quartzites. Though the

drainage of North-Eastern Munno Para, North-Western Para Wirra, and South-Western Barossa, through this numerical reducing and thinning-out to the north of the Munno Para quartzites, finds a comparatively easy outlet to the west. On the other hand, it will be seen that the quartzites intersect the modern watercourses bounding the district on the south-east and south. Thrice had these drainage waters to contend for mastery with the quartzites ere they succeeded in penetrating the stony mass.

I may here state, from the nature and geological structure of the Para and southern Munno Para hills, that in early geological times the drainage of Gould's Creek, Little Para, and adjoining regions was carried off by way of Golden Grove and Modbury, meeting the waters of the then Southern Ocean, probably not far from where the City of Adelaide now stands.

Upland Miocene.

Description of Strata.—These beds attain no great thickness throughout the district, and the bedding may be said to be somewhat indistinct; nevertheless, what still remains, in descending order, can be read as follows:—

The Upland Tertiaries of Munno Para consist chiefly of soft, fine-grained, friable sandstone. The silicious materials frequently held together by an argillo-calcareous paste, not unfrequently impregnated by infiltrations of iron oxides. Though such be the general characteristics of the formation, I have not unfrequently found the basement consisting of one or more of the three following description of beds:—(1.) Angular fragments of quartz and other rocks (which might be termed a *breccia)*, held together by a ferruginous paste. (2.) Though less common, conglomerates, in the true sense of the term, in some cases held together by a cement of argillo-calcareous material; in others, as in the case of the *breccias*, by ferruginous matter. (3.) Most commonly, however, the basement of the deposits consists of mottled argillaceous sand rock, evidently the characteristic sandstone in a high state of decay.

Range of the Formation.—The Upland Miocenes of Munno Para constitute a group of outliers, scattered chiefly over the higher tracts of the district. But these isolated patches are to the geologist of significant meaning, as each of them, when systematically arranged, becomes an integral part of an intelligible language, and though time no doubt has wrought sad havoc in defacing the surface outlines of the country since the period when the deposition of these beds terminated, yet sufficient still remains to indicate that they once overlaid pretty

nearly, if not wholly, the fundamental rocks of the entire area.

On directing attention to the various outliers *in situ*, I shall commence at the south end of the district, pointing out the situations and characteristics of those occupying the higher tracts as we proceed north, afterwards indicating the relation of three patches found *in situ* on the western base of the range.

Beginning, then, on the south, part of Section 4233 is occupied with Upland Tertiaries; from that point northerly these beds continue to overlay the fundamental rocks in part of Sections 4195, 4196, 4232, 4201, and 4230, in which section the superficial area increases considerably, at the same time trending to the east, occupies about one-half of Section 4193, part of 4231, 4362, and about four-fifths of 4363. With exception of the depression or channel of Little Garden Creek, the series passes as a whole into Para Wirra, occupying from 80 to 100 acres in Sections 6381, 6382 in that hundred. I may note, in passing that at the junction of the diagonal roads leading through Section 4363, the watershed of Little Garden and Gould's Creek is situate at an elevation of about 700 feet.

From the lowest point in the south-east corner of Section 4357 the beds continue to occupy the rising ground to the north into Section 4156, where they attain an altitude of something over 890 feet. From this elevation they gradually thin off, until in a small valley from 150 to 200 yards north, the old rocks for a distance of nearly half a mile are completely stripped of their Miocene covering. In this little valley, according to the Railway Survey Department, the elevation is 872 feet. Passing north, in Sections 4676, 3263, 3262, 3266, and 3267, they attain their former development, occupying in the aggregate about 150 acres. In Section 3262, where the cross section accompanying this paper intersects the roadway leading through same, the elevation is 960 feet; from which point, as we approach Yatalunga, a small outlier of the series occurs on the highway at the northern boundaries of Sections 3260 and 3267. From thence the old rocks are entirely stripped of the newer series for a distance of about one and a quarter miles, where a few characteristic fragments are to be seen in Section 4191. And lastly, at an elevation of 978 feet, the Gawler Town hill is capped with Upland Miocene, identical in all respects with the deposits of the same horizon at lower levels. These beds are distributed not only over the higher tracts of the district, but also repose at low elevations on the western slopes of the range. An inlier surrounded by drift occupies the bed of the creek in Section 3328; and two small outliers

occur, one in Section 3087, at an elevation of 340 feet, and the other in Section 3306; both are *in situ*. As further evidence of their general prevalence at a former period, detached fragments of quartz, quartzite, and various other pebbles imbedded in a ferruginous paste, also fragments of the ordinary prevailing Miocene sandstone, all characteristic of the formation, abound in the soils and subsoils throughout the higher tracts of the district. Such detached masses occur notably in Sections 4173, 4148, 4149, 4147, 4160, 3309, and many others. Further proof is afforded by the occurrence of highly water-worn pebbles in the soils at various places, especially in Section 3309, at an elevation of about 550 feet, and though less profusely, most characteristically so in Section 4160. These pebbles are of various sizes and kind, and are evidently the remnants of a Miocene shore line.

Vertical Extent and Stratigraphical Relation to the Primary Rocks.—Because of their great capacity for water, and that in consequence vertical abrasion is reduced to a minimum, no well-defined section is presented throughout the whole area; and though all my measures are merely approximate, yet I think in several places the formation extends to 30 feet. The deepest and best exposure is in Section 3263, where Mr. Philip Butler essayed to open a quarry for the purpose of obtaining stone for the ashlar-work of his mansion erected at Yatalunga 28 years ago. Though the stone at this place rather exceeds the general average, both in colour and quality, yet after penetrating to a depth of ten or twelve feet it was abandoned on account of its exceeding brashy character.

They everywhere rest unconformably over the uptilted edges of the *Palæozoic* or *Eozoic* rocks, and the basement bed of the formation is usually an arenaceous mottled clay, but it is sometimes a breccia or conglomerate; these various characteristics of the bottom beds being overlain by a white silicious sandstone of variable thickness and colour.

Vegetation.—Throughout the actual area, and that covered by waste from the Upland Tertiary beds, the soil is of the most sterile character; consequently vegetation, though represented by a goodly number of indigenous flowering plants, presents for a considerable portion of the year a most barren and dismal aspect. But at spring time these shrubs and herbs, then in blossom, impart a most pleasing effect to the landscape. The grasses are all indifferent fodder plants. Timber of all kinds is also small and dwarfed in size; in short, forming a criterion from the vegetable life as developed over the Munno Para Upland Tertiary outliers, it is well that they have been reduced to their present circumscribed area, otherwise Munno Para

would be now constituting part of an Australian desert, even though its climate is a fair average for South Australia.

Professor Tate has very kindly supplied the subjoined note:—"The following plants are restricted in Munno Para to the Upland Miocene surfaces. Among shrubs and undershrubs —Hybanthus floribundus, Boronia cærulescens, Leptospermum myrsinoides, Calycothrix tetragona, Hibbertia densiflora, H. fasciculata, Grevillea lavandulacea, Hakea rugosa, Banksia marginata, Isopogon ceratophyllus, and Styphelia Sonderi and other epacrids. Of herbaceous plants the following are conspicuous by their profusion and brilliancy of blossom:—Burchardia umbellata, Thelymitra longifolia, Diuris maculata, Prasophyllum fuscum, Caladenia Patersoni, Pterostylis longifolia, and Glossodia major; Drosera auriculata, Euphrasia Brownii."

Water-bearing Properties of the Beds.—No permanent spring of noted consideration issues directly from these beds. Nevertheless, when we consider not only the exceedingly pervious character of the newer rocks, but also the nature of the surrounding debris (a pervious sand, in many instances extending far beyond their present limits in actual *situ*), it is reasonable to infer that they materially add, in an indirect way, to the subterranean water supply which issues forth at lower levels from the fundamental rocks.

A rough approximate of the annual storage of water derived through the direct action of these beds and surrounding detritus may be reckoned as follows:—Superficial extent, 1,400 acres; average rainfall, 22 inches. The usual method of solving such problems, when the upper rock stratum and its superficial covering consist of medium permeative constituents, is to allow two-thirds of the annual rain-water as being carried off in the shape of flood-water and by evaporation. But a personal knowledge of the exceedingly pervious nature of the beds in question and that of their superficial covering leads me to infer that $14\frac{2}{3}$ inches exceed the actual amount of loss thus sustained. Consequently I estimate the loss at 10 inches. My calulations are embodied in the following table:—

Superficial area, 1,400 acres.		
Annual average rainfall	22 inches.	Total in gallons, 697,466,000
Loss by flood-water, evaporation, &c.	10 inches.	Total in gallons, 317,030,000
Stored in the strata	12 inches.	Total in gallons, 380,436,000
Daily product therefrom		in gallons, 1,042,290
Numbers of persons that might be supplied at the rate of 40 gallons per head a day.	.. ..	26,057

It may be observed that though the Upland Tertiaries of Munno Para present a gloomy and weird aspect in so far as

the vegetable kingdom is concerned, yet their sterility in that respect is wonderfully modified when we consider the great redeeming feature they present, viz., a vast storage of water for summer supply to the adjoining neighbourhood.

Origin. No Fossil Remains as yet Discovered in Munno Para.—The origin of this formation, so widely distributed over the country, is at present one of deep interest to the geologist. In the early days of my geological aspirations I was of opinion that the Upland Tertiaries of Munno Para were of subaerial origin. But since my intimate acquaintance with our esteemed President—my own observations, in the meantime, having also extended beyond the limits of the Munno Para beds—I have relinquished that hypothesis as being one inadequate to meet the requirements of the case. Professor Tate is of opinion (see President's address to the Society, 1878-9, page 59) that the formation is of "fresh water origin," and considers it to be "contemporaneous with the youngest members of the Miocene marine strata." In the absence of further discovery of fossil remains, arguments both for and against these views might be raised. I presume the reasons which led the Professor to that statement were that the formation has hitherto yielded no remains of marine life, and that silicified wood, which is a common representative of lacustrine or fluviatile deposits, has been frequently found associated with it. It might be advanced with equal propriety that because of the wide-spread extent of the formation over hill and dale facing the present seaboard from an elevation at Gawler of something less than 300 feet to that of 1,000 elsewhere, the fresh water deposits could not be going on simultaneously with any member of the marine, unless a natural barrier then existed very near a considerable portion of the present eastern coast-line of Gulf St. Vincent to impound the fresh water from the salt. Having no positive evidence to that effect, I think that the age of the Upland Tertiaries, if they be of fresh water origin, most likely preceded the marine Miocene.

Mr. O. Tepper, of Ardrossan, has probably shed more light on this subject than any other inquirer in the field of South Australian geology (see Proceedings of this Society, 1878-9, "Cliffs and Rocks of Ardrossan, Yorke's Peninsula," by O. Tepper, page 75). By this discovery I regard Mr. Tepper as having so far at least traced a stratigraphical connection between the fossiliferous beds near Muloowurtie Point and the unfossiliferous beds of Tanunda and other inland tracts. Therefore, Mr. Tepper's discoveries only await further corroborative evidence to establish the opinion I have for some time entertained, viz., that the patches of Upland Miocene are merely remnants of marine bottom beds.

From the foregoing it will be noticed my argument favours the theory of marine origin. And although the only fossil hitherto discovered in the Upland Miocene is silicified wood, yet its presence is no proof of a purely lacustrine origin of the deposits, inasmuch as terrestrial vegetation has been frequently found associated with indubitable marine fossils. So far as I know, the Upland Miocenes of Munno Para have not produced a single specimen of silicified wood, though it has been procured from the *debris* of a neighbouring outlier in Para Wirra. Indeed the marine beds at Gawler seem to be the great emporium of these ancient vegetable relics, and from careful observation I am led to conclude these chiefly grew near the spot where they are now found.

Relation to the Auriferous Cements of Barossa and Humbug Scrub.—That the deposition of the Upland Tertiary beds of Munno Para and the auriferous cements of Victoria Hill and other old gold-bearing gravels of Barossa and Humbug Scrubs belong to the same geological period a doubt cannot be entertained. Ascending from Gawler, they can be traced overlying at intervals the rugged surface of the old rocks, until at the Victoria Hill and Lady Alice Mine they attain an altitude of about 950 feet. Indeed their relationship is so easily read and defined in that respect that in cases where altitude coincides deposition may be regarded as having been contemporary.

Why the easterly tracts of the Upland Miocenes have become more auriferous than those in Munno Para may be attributed to a higher state of metamorphism prevailing throughout the fundamental rocks to the east.

Fundamental Rocks.

Supposed Age.—Until the appearance of Mr. Tepper's "Rocks and Cliffs of Ardrossan," the fundamental rocks constituting the Adelaide and Flinders Ranges and other minor groups traversing the southern sea-board of South Australia were considered by the most eminent authorities to be not older than Silurian. Mr. A. R. C. Selwyn, in his report to the South Australian Government of a Geological Tour in this Colony in 1859, in his usual careful way of expression, supports that hypothesis. Basing his conclusions from natural sections of the country, they are:—

That an unconformable series tops the summits of a large number of the highest of the South Australian hills. The higher series he regards as of Devonian age, and in the absence of fossils he concludes that the unconformable subterimposed beds belong to the system next in point of time, viz., the Silurian.

In 1866—"Physical Geology of Victoria," page 16—whilst

treating of the Upper Palæozoic rocks of the sister colony, we find that geologist still further modernising the position of our fundamental rocks. "Whether," he says, "the cupriferous, calcareous, and slaty strata of South Australia are, as I am inclined to believe, members of the same group, is uncertain. If so, they have not yet been recognised in Victoria." Valuable, however, as Mr. Selwyn's geological observations are in other respects to South Australian geology, yet his deductions now require modification in accordance with Mr. Tepper's Peninsula discovery, that of Lower Silurian fossils in beds unconformably overlying the slaty cupriferous group of Selwyn. But until more light is shed abroad on the subject we may designate the group of rock constituting the Adelaide chain and Munno Para hills by the somewhat ambiguous term "Pre-Silurian."

Geological Structure, Extent, and Surface Characteristics—A glance at the map and cross section will show the geological structure of the Munno Para hills to consist chiefly of clay slate, frequently intercalated with bands of quartzites, and less sparingly of marbles, and occasional veins of pure quartz, principally in small nests and strings throughout the clay slate. The length of the range may be estimated at from 24 to 26 miles, taking its rise on the south, a little to the north of the northern boundary of the City of Adelaide, trending northerly through Yatala, Munno Para—where it attains its highest altitude—losing its characteristic outlines north of the South Para River. The topography of the range is solely due to denusive action, therefore the undulating and fertile table lands of the Munno Para hills owe their outline and fertility to the diversified character of the fundamental rocks out of which they have been fashioned.

Quartzites.

Believing that the quartzite bands have acted a conspicuous part in delineating the topography of Munno Para, I have arranged them as follows, viz., west and east escarpment, and middle or mill series.

Using the cross sectional alignment as a base line, it will be observed that only two of the separate bands of the western escarpment series appear at the surface there. Proceeding south, they are traceable through Sections 4161, 4148, 4147, 4159, and south-western portion of 4160. From that point, for some distance south, both bands (especially the western) become obscured by an easterly extension of the *Drift* formation in the ancient gorge of Smith's Creek. The eastern one is well exposed in a quarry in Section 4164. Strike of quartzite as exposed in quarry 10° west of north; dip 25° easterly; esti-

mated thickness, 70 to 80 feet. The general dip of the strata seems to increase rapidly to the south, for in a gully trending east and west through Section 4166—wherein the eastern quartzite band is exposed in a contorted state—the dip of the clay slate, about 70 yards east of where the quartzite finally plunges beneath the slate, is 40° east. As represented by pl. vi., fig. 1., the rocks here have been powerfully affected by an east and west pressure, and had the quartzites chanced to have been less exposed a casual observer might readily have been led to conclude that the distance represented by the diagram contained at least five quartzite bands, whereas there cannot be more than two. Likewise it will be noticed that if denudation had extended a few more feet in depth the contorted quartzites would have been entirely swept away. South from this point the old rocks extend to the west, and include three additional quartzite bands, which in places—notably so in Sections 3271, 3272, and 3273—have undergone a considerable amount of east and west pressure, the effect of which has produced a bold surface outline toward the Little Para.

A peculiar quartz reef, or dike, first begins to attract attention from the *debris* scattered over the surface on the western side of the eastern band of this series in Section 3091. At the southern boundary of Section 3094, it is fully displayed at the surface; and in a gully in Section 3268, it has attained great proportions, and is somewhat columnar in structure. Its strike at this place is about north-west by west, its dip from 70° to 80° south-west. Beyond this point it is not seen, but about one hundred yards west by south, in Section 3270, a detached portion of the same material, some thousands of tons in weight, is exhibited in regular order poised on a substratum of clay-slate.

Williams' quarries, in Section 3092, are opened in the western bands of this series. A splitting up, or repetition, of one or more of the bands appears to have been effected here, for in the gully where the quarries are situate four bands of quartzite are seen intercalated with the clay-slate in the distance of little over 400 yards.

In the bed of the Little Para River, on the eastern side of Section 4,400, a quartzite band is there seen in horizontal stratification, which phenomenon, in connection with that at Williams' quarries and several others of a similar kind throughout the district, leads me to infer that the various bands (some at least) as exposed at different inclinations in the bed of the river and elsewhere, are repetitions at the surface of the same beds.

Returning to the north of the cross section. The quartzites

as exhibted in a gully leading through Sections 3247, 3306, 3305, and 3304, are, with the exception of one small break in the series, contorted and squeezed together in such a manner as to represent a continuous whole for a distance of at least sixty chains. As will be observed by the map, the western portion of this series of foldings is no longer traceable, because buried beneath drift. The eastern limb, however, can be distinctly traced into a gully about four chains north from the southern boundary of Sections 3302 and 3303, where the foldings, are very distinctly shown. Between this point and the former, a distance of about 32 chains, the average strike is about 10° east; a few chains north of this the strike suddenly veers to the west about 20°, plunging the whole series under the drift shortly after entering the south-west corner of Section 2183, where no sign of folding is visible.

About half a mile south-east of north-west corner of Section 2183 a quartzite band feathers in amongst the clay-slate. Though comparatively thin on its first appearance, it increases in thickness on its way north, and in a gully in Section 3326 it has attained a thickness of at least 100 feet; the dip is here 60° east. For some considerable distance it again thins off. To the north, in a gully in Section 3325, the thickness is not more than 40 feet; the dip also has fallen to about 40°. From this point it veers slightly to the east, and from the effect of an *anticlinal fold*, and also a thickening of the beds—as shown in Sissman's quarry, Section 3325—might be attributed the bold outline of the hill embraced by Sections 3324 and 3325. This quarry of road metal has been excavated in the focus of this anticlinal fold, and the beds are very much fractured, and split into all shapes and sizes; as also the band seems to be much thicker than it was in the gully in Section 3325. This disturbance of the strata has evidently extended north, for in a ravine in Section 3328 the quartzites are not only seen in a very massive state, but also as if repeated more than once; and what is even more interesting, the bands, so massive and numerous here, cannot be traced further. They do not appear even in the bed of the gully leading through Sections 3334 and 3216; but on reaching a ravine leading through the northern side of the latter section, the quartzites are here consecutively intercalated with the clay-slates from the eastern margin of the drift to the eastern boundary of the section. Beyond this gully they are not traceable.

Middle or Mill Series.—This series traverses the district pretty uniformly from south to north. Commencing in Sections 3309 and 4174, where, intersected by the cross section and following their outline south, they continue to follow a pretty uniform course until reaching Sections 5675 and 4170, at

which point the eastern band trends slightly to the east. These bands, more especially the eastern one, have acted a most prominent part in deflecting south the courses of the Little Para and Gould's Creek. After the eastern band intersects the bed of the former stream its outcrop bears considerably west. I am inclined to think that here and for some distance south that the eastern band is represented by the remnant of an anticlinal roll. For, as shown in the map, it splits into two in Section 5671, the eastern branch crossing the bed of the Little Para into Yatala, at the Reserve, a little below Richardson's; the western, sweeping on with the course of the river for a considerable distance, in conjunction with the middle and western bands, constitutes the eastern escarpment of the Munno Para hills.

Returning to the north of the cross section, the eastern member of the series trends somewhat abruptly to the east in Section 4179. Pursuing a somewhat sinuous course, it finally terminates, with those of three eastern series, in Section 3330. The middle and western bands, however, follow a more direct course, intersecting the South Para River in Section 3346. This statement is only fully proven so far as the middle band is concerned. The point where the western band should intersect the river—if it extend to there at all—is much obscured by a surface covering of *wash* from the adjoining slopes, therefore its position, as laid down on the map, for a considerable distance south of the river must be regarded as somewhat ideal.

Dip and Strike of the Mill Series.—In a gully passing through south-east corner of Section 3309, about 18 chains south of cross section, the dip of the western quartzite is 40° east. In the same gully, about 120 feet below the horizon of this band, the dip of the clay-slate is 55° east, the strike 5° east mag. north. Estimated thickness of quartzite, 50 to 60 feet. In the same section, in a gully to the south, the easterly dip of the quartzite band has increased to 5°, thickness about the same. In the same gully, in Section 4173, dip of the slate about 60 feet below eastern band, 45° east, strike 5° east. Slate about 60 feet below middle band in Section 4160 (Smith's Creek), dip 35° east. At the old mill (about 10 chains west) dip of quartzite band the same. In a gully leading through Section 4165 false bedding in the clay-slates is very distinctly represented; and although no accurate bearing of the quartzites could be ascertained, the dip of the surrounding slate is about 48° east, strike, 10° east mag. north. In northern portion of Section 4168, and southern portion of 4165, a remnant of one of these prevailing folds so common throughout the strata of the district is distinctly observable here. Also at junction where

gully leading through Section 4168 intercepts that leading through 4165 another of these folds, I am persuaded, exists there; for not only has the outcrop of the western quartzite band increased to the extent of from $3\frac{1}{2}$ to 4 chains over the surface, but the dip of interbedded slate has decreased very materially also; the actual dip of which, about 50 feet below the western quartzite band, is 31° east, thus showing within a very short distance a lowering of the dip to the extent 17°.

The movements causing the displacement of the original conformity of the strata, if I judge aright, have operated in a line nearly 5° west of mag. north, and east of south, for about one quarter mile south in Section 4168. The same phenomenon presented in the western band at junction of gullies in Section 4165 is repeated in the middle band on the southern side of Section 4168, and, nearly in the same alignment south, the eastern band has either been affected by the same disturbing agency, or that some very decided movement of sea and land intervened during the deposition of the eastern quartzite band; for, as before mentioned, it splits into two in Section 5671, and passes into Yatala in that condition. In middle band at northwest corner of Section 4170, a very fair rough building stone could be procured. On western side of river, southern boundary of Section 1560, dip of the slate 28° east, strike 5° east. As represented in cliff on eastern side of the river in Section 1560, the western member of the eastern band there measures from 50 to 60 feet in thickness. A little further west the middle band is exposed in a fine section in the shape of a miniature waterfall. The western band is not so well exposed either on the north bank or in the bed of the river. However, all three are conspicuously seen in regular order, as they obliquely ascend the bold ascent on the southern side, finally passing in their course to the south, forming a component part of the bone structure of the Para hills.

Remarks, North of Cross Section.—As the eastern band is removed from its associates by an additional amount of clay-slate, it also becomes thicker, and its lower portion, in Sections 4181 and 3322, almost assumes the character of true quartz. Estimated thickness in Section 3322:—Underlying quartzy beds, 20 feet; true quartzites, 30 feet; dip, 40° east; strike, 10° east. This quartzy character disappears as the band passes through Sections 4350, 4353, and 3317, but reappears for a short distance in Section 3316. The outcrop of the western band exhibits a well-defined course through Section 2183, but it is not so with the middle. In its course through the southern portion of Section 2183 the western band has evidently undergone a reversed anticlinal fold in a north and south direction. At this point the band measures fully five chains

over the surface from east to west, and within that space the quartzite beds are found dipping in both directions. Western side dip not ascertained, eastern side dip 35° east, strike 10° east. A few chains north of this point, and about six chains east from the outcrop of the band, seemingly a reef of quartz of milk whiteness steals in amongst the clay-slate, running parallel for a little distance with the strike of the quartzites. At a distance of about one quarter mile we reach the spring (Spring Gully); here the band is split into three sections. Thickness of the western section, about 80 feet; dip, 77° easterly; strike, 10° west; overlying clay-slate, about 40 feet; dip, 75° east; strike, 8° west; quartzite, about 40 feet; dip, 75° east; strike, 8° west; clay-slate, about 80 feet; to the east of which is exposed the largest section of quartzite, representing, from west to east, a surface measurement of four chains, the western side of which is dipping west at an inclination of 65° west, strike on that side of the fold 10° west. On the eastern side of this partially abraded fold the actual dip of the quartzites was not ascertained. Two chains east from their junction with the clay-slate the dip of the latter was found to be 70° east, strike 8° east.

On the north slope of the gully the phenomenon presented at the spring becomes altogether obscured, but in a gully obliquely intersecting northern boundary of Section 2183 the band is again exposed in a connected form, though still exhibiting a somewhat irregular and confused appearance; dip of slate rock on western side 70° east, strike 10° west. It then passes on through Sections 3323, 3324, and 3329, where it becomes entirely covered with slate rock, in which state I believe it passes through Section 3333—marked spring—for in the bed of a small gully near the southern boundary of Section 3336 the round back of an anticlinal roll is seen peeping out under the overlying clay slate. From this point, both the western and middle bands—(nothing of particular interest is connected with the middle band north of cross section)—seem to split up into detached and unreadable sections, as they pass through Section 3335; and in Section 3343, it becomes almost impossible to define the position of their outcrop, and so continue in that obscure state until reaching the south bank and bed of the River Para in Section 3346.

Eastern Escarpment Series.—By the map it will be seen that a distinct series of quartzite bands traverses the eastern side of the uplands of the district. Their general bearing is considerably more west of north than those traversing the western escarpment of the Munno Para Hills. I have thought fit to term the series as above, because, whilst the features of the country were being sculptured by the successive action of

denusive agency, they preserved a somewhat similar bold outline on the east, as the western ones did on the west. It will also be observed that not one member of this series extends so far north as Section 3331 All, with one exception, intersect the bed of the Little Para, and on the south side of the river impart a bolder outline to hill and dale.

A common character prevails throughout the bands of this series. In a ravine in Section 4191, east of Gawler Town Hill, a very fine section of the eatsern band is exposed, presenting a synclinal axis, as represented in diagram I. The rock here is very hard and compact in structure; and also the massive bedding is exceedingly well defined. In consequence of this fold, as abrasion brought each succeeding bed nearer the surface, so at last when denudation has excavated below the axis of the syncline the band has entirely been removed. This takes place at a distance of less than half a mile north from where it is so fully developed. As will be seen by the map a lateral overlap of this band occurs in Section 1645. Whether this severance of the quartzites be due to original deposition or to dislocation of the strata, as yet I have not been able to determine. Dip of this band, at about 200 yards north of cross section, is 70° east.

Eastern Isolated Band.—As shown on the map this band is entirely confined within the limits of Munno Para; its strike bears more west and east than any of the others, and I am inclined to believe that it is only an extensional fold of one or other of the bands to the west of it, from which it has been removed so far in consequence of its low dip, and the depth to which denudation has been carried. On the South Para River it is entirely cut off to the north by abrasive action, the waters of the river having cut a channel into the slate rock nearly 100 feet below the synclinal axis of the quartzite. Throughout the highlands of Sections 3347 and 3348 the western limb of this synclinal curve can be also traced to its termination there by the tortuous outcrop of the quartzites.

A natural section of this band, in a gully a few yards north of the southern boundary of Section 1783, shows a down-throw between two faults. The dip of the adjacent slate is conformable to that that of the quartzites abutting against either fault. At a distance of a few chains east, however, the westerly dip of the slate gradually changes to the east. The faults, which are here about four chains apart, traverse the country in a south-south-east direction, in such a manner that at no great distance south they become connected as one fault, and that at, or soon after, their intersection, stratigraphical discordance is no longer traceable.

If solely guided by geographical demarcation, this band completes the Munno Para series to the east. As it happens in this case the geographer's line of demarcation coincides badly with the geologist's. Consequently, I have extended the cross section rather over one mile into Para Wirra, embracing a limestone band, an extensively developed series of quartzite bands, and thus constituting a geological line of demarcation between the less metamorphosed clay slates of Munno Para, and the mica-schists of Para Wirra.

Origin.—A singular coincidence, one that has not escaped the keen eye of Professor Tate—see his Presidential address for 1879—is that the fundamental rocks when followed easterly in the direction of their prevailing dip become more highly metamorphosed; for it is true that vast accumulations of granite and granitoid rocks, whether of Plutonic or Metamorphic origin, are distributed throughout the old sedimentary rocks constituting the range on the west of the River Murray. That the superabundant heat arising from what we see of these outbursts conveyed direct should have effected the condition of the strata so far west as the western boundary of Para Wirra is very improbable. Nevertheless, I am of opinion that the same fiery energy which produced the granite and granitoid rocks of the Murray Range, effected at the same time the metamorphism of the Para Wirra beds from a deeper seated point. A bed of rock on the surface in Para Wirra, from its natural inclination, as it extends east becomes deeper buried beneath succeeding beds, and also nearer the seat of Plutonic energy. Therefore, the bed which at the surface in Para Wirra represents a mica-slate, in all probability at a moderate depth represents gniess, at a greater granitoid, and at still greater depths, and also proceeding into closer proximity to the superheated mass, a true granite. In this manner, though youngest in the series, the Para Wirra rocks may have been affected by capillary conduction of heat directed through the plane of original bedding, though placed at considerable distance from the scene of actual fiery activity. Another theory might be propounded, which is also the most probable, that the fiery energy that produced the granite and granitoid rocks to the east occupied a deeper-seated horizon in the west as it extended beneath the Para Wirra beds, and thus affected them vertically upwards.

Mr. A. R. C. Selwyn, in his valuable "Geological Notes of South Australia," suggests that some at least, if not all, of our quartzite bands might be looked upon as being metamorphosed Plutonic rocks—a theory which cannot be applied to any of the Munno Parra bands, unless possibly to one of them. A flying excursionist, as Mr. Selwyn was whilst here in official

capacity, dropping across a quartzite band in a highly metamorphosed condition would be very apt to ascribe it to a Plutonic origin, as being the more simple explanation. Having no intention whatever to gainsay the opinion of so able an authority as Mr. Selwyn has proved himself to be in other respects relative to South Australian geology, yet after a careful investigation of any given band for a considerable distance, the invariable conclusion has been favourable to its sedimentary origin. Proof of their sedimentary origin can be adduced as follows:—1. Because of their uniform interstratification with the surrounding clay-slate. 2. Though fractured extensively by lateral pressure they still retain the outlines of original beddings. 3. The quartz grains building up the lesser metamorphosed specimens invariably bear a water-worn appearance. 4. Though not abundant, characteristic water-worn pebbles of a pre-existing quartzite have been found imbedded within them; also, on one occasion I found an enclosed fragment of considerable size of a pre-existing clay-slate.

The foregoing, to my mind at least, fully establish the sedimentary origin of the quartzites, and from the nature of the deposits it is inferred that dry land existed not far away, but in what direction it is scarcely possible to hazard an opinion. This much might be inferred, from the small percentage of embedded pebbles within them, that in whatever direction this ancient land was situate it did not present a bold coastline.

Clay-Slate.

This class of rocks constitutes by far the largest moiety of the fundamental rock system of the district. In some cases the beds are found gradually passing from a fine gritty quartzite to that of the characteristic slate. In others the slates are divided from the quartzites or marbles simply by a flaky parting. Frequently metamorphism (which in no case throughout the district of Munno Para has acted intensely) has most powerfully affected the slates near their junction with the quartzites, quartz reefs, nests, and strings of quartz. Near their junction with the latter, frequently the slate has become chloritised in character, slippery to the touch, and greenish in colour. Where metamorphism has acted moderately, especially where soda and other allied chemicals are present, the slate beds are in a state of rapid decay. Thirty years' observation has led me to believe that in situations where these allied influences are in unison abrasion of the clay-slate is going on at the rate of several inches per century.

MARBLE, OR METAMORPHOSED LIMESTONE.

In no case have I been able to trace this class of rocks continuously throughout the entire extent of the district. This fact at once leads me to conclude that their deposition was more restricted by local influences than that of the sands now constituting the quartzites. I have invariably found that abrupt depressions of the surface indicate their lines of outcrop. The beds have a tendency to decay pretty uniformly with the intercalated clay-slate, and in the low-lying parts they are covered to a considerable depth with recent *debris*. It is, therefore, only by the aid of these depressions and where they stand out in bolder relief on the ridges, that their outcrops can be traced extensively at all.

Beginning from the west, the first in order of the Munno Para marbles is a compact grey stone, overlying, at a distance of 30 feet, the eastern quartzite band of the Mill series. In Section 4173 it attains no great thickness, and I have not been able to trace it further south than into Section 1678. But by the aid of the above-mentioned surface depressions I have followed the line of outcrop north into Section 4350, where a very good section of the outcrop is exposed, averaging a thickness of from 12 to 20 feet, and further extension in this direction is indicated by the presence of surface blocks of the same kind of stone.

No. 2. A black stone, somewhat slaty in character in places, is situated about 12 chains east of the former. It follows a north and south line into Section 4178; by the help of the surface depressions I have been enabled to follow the line of strike south into Section 4215. The limited exposure of the bed prevents accurate measurement of its thickness being taken, but in Section 4173 it is estimated at from 30 to 40 feet.

No. 3. Intersects cross section in Section 3266. Its position is only inferred by a chain of surface depressions, and a few small blocks strewn over the adjoining surface.

No. 4. Another stratum peeps out, though faintly, in Sections 4146 and 4350.

No. 5. As shown on map, passes through Sections 3347, 3348, and 3349.

No. 6. Still further east another band occurs in Section 1032 and 1033, the strike of which is about parallel to that of the eastern quartzite band. No. 5, in passing south, from about five chains within Section 3348, trends in the same direction.

Also on a spur overlooking the bed of the river, in Section 1787, an impure marble has been detected.

Origin.—The occurrence of limestone suggests the proba-

bility that life existed in the sea in which it was deposited; but as lime must have formed a constituent of the waters of the ocean before life was there to utilise it, and knowing the rocks constituting the Adelaide chain and Munno Para to be much older than the Silurians of Yorke's Peninsula, it is quite possible that the material forming the marbles of our ancient fundamental rocks was collected from the early water by direct chemical agency.

Quartz Reefs.

Except the vast mass referred to at page 114 (if it be a quartz reef), and one peeping out in a gully excavated in the drift in Section 3036, and nests and strings frequently occurring throughout the clay-slate, no other sign of quartz reefs, in the true sense of the term, occurs throughout the rocks on the western side of the watershed.

On the South Para River, however, in Sections 3347 and 3348, a pure white quartz vein is seen trending in a north and south direction, seemingly in conformity with the dip and strike of the surrounding strata. Also another occurs in like conformity with the general stratification in Section 1033. Near this place in the bed of the river, the old alluvial workings are situated, where gold in anything like paying quantities was first discovered in South Australia, in 1850; and these attracted the attention of a few until the advent of the gold mania in Sydney and Victoria. From what I have been able to gather of the nature and character of the gold found here, I am inclined to think it was not derived from the adjoining quartz reef, but had been transported hither from a distance, probably from some extinct outlier of the gold-bearing Miocene gravels of Barossa.

Economic Purposes.

Copper.—Slight indications of this metal have been found staining the nests and strings of quartz distributed throughout the clay slate. However, up to the present time no find has been made of sufficient importance to induce a systematic search.

Iron.—An ore of this metal is indicated as occurring in interstratification in the cross section. I am, nevertheless, not yet quite convinced whether or not it is correctly so placed. Surface indications, however, in Sections 3267 and 4146, and elsewhere over the same line of strike, have induced me strongly to infer that an interstratification of that mineral occurs in the fundamental system near the place shown in section, pl. vi., fig. 2.

Building Material.

Embracing the fundamental rocks, building material, such as it is, is plentiful throughout the eastern tracts of Munno Para. As might be expected the best is obtained from the quartzites, and these (with the exceptionof Williams's Quarry, Section 3092; Billings' Quarry, Section 3094; and Bald's Quarry, Section 3306—none of which could be used for fine ashlar-work) are fit for strong rubble work only.

No attempts have been made to procure building stone from the clay-slate except to the east of Gawler South, and as the stone seems to be less adapted for building purposes than that from Glen Osmond—and even this, to my mind, is deficient in some respects—I cannot recommend its use.

Fundamental Limestone.—No natural sections of these beds are displayed throughout the district; nevertheless, along the line of strike advantageous sites for quarries could be selected, and, in my opinion, an excellent and durable building stone could in many cases be procured.

Travertine.—Very little of this material has been used in Munno Para for building purposes, unless it be for mortar.

Mortar.—The travertines of the Munno Para hills, on account of various impurities, are poorly adapted for building purposes generally. Probably the greatest defect is their including small nodules of fundamental limestone. Unless the greatest care is exercised during the process of slacking, the inclusions remain undissolved, bursting and destroying the work months after its execution.

Sand.—Sand of very fair quality for building and other economic purposes is procurable from dunes of a similar character to those situate in the neighbourhood of Alberton throughout the lower tracts of the district. In the highlands the waste from the Upland Tertiaries furnishes a material for finishing plaster work not surpassed by anything obtained in the colony.

Brick.—In no case, to my knowledge, except at Smithfield—where the works are abandoned—has this auxiliary to the builder been manufactured. Should a demand ever spring up abundance of raw material will be found throughout the redepositions of the drift, along the banks of the Gawler and Little Para Rivers.

Road Metal.

If discriminate selection were exercised by those in power over our macadamised road system, abundance of most durable road metal could be procured throughout the quartzites and fundamental limestones of Munno Para. As already stated, in some of the quartzites the feldspathic paste

is in a high state of decomposition, so that stone of this kind, though containing much silica, is, nevertheless, exceedingly friable; and when such is used for road metal the percentage of argillaceous matter is altogether insufficient to hold together the more indestructible, but incohesive, particles of silica. Roads constructed or repaired with such material always present during our hot and dry summer months a rough and gritty surface, every casual puff of dry wind renewing the grating powers of the rasp.

Fundamental Limestone.—With all due respect to the opinion of the members of our various Road Boards, District Councils, and superintending officers, I am persuaded that they would do well to direct greater attention to this class of material for road-making and mending purposes. Being fully convinced that the metamorphosed limestones of Gawler Hill are 100 per cent. more durable for road purposes than many of the quartzites used, I venture to suggest to those in authority that the marbles should have at least a fair trial.

Travertines.—Except where the traffic is light, or for blinding purpose, those of Munno Para are not adapted for road construction.

Clay-slate.—The harder sorts, when broken to 4 inch gauge, make a very fair foundation for new roads. Also, I am of opinion that a mixture—say of one to six or eight—broken up with quartzite, would tend to bind and prolong the wear of that material greatly, having seen the highly decomposed specimens of that rock used to great benefit in blinding over quartzite metal.

Springs issuing from the Fundamental Rocks.

Probably no like extent in South Australia can boast so goodly a number of surface springs of excellent water as can Munno Para East. To obtain that happy condition the country must necessarily possess the following qualifications:—First, an absorbent super-stratum; second, a moderately retentive sub-stratum. These geological characteristics Munno Para East naturally possess in a marked degree, therefore it behoves the occupants of the soil to see that these natural gifts are not infringed upon.

In a former part I had occasion to direct attention to the exceedingly absorbent properties of the Upland Miocene bed. My object now is to show how the waters directed from the surface by the action of these beds into subterranean channels again re-appear at the surface in the shape of refreshing springs. A glance at the map will show the absorbent, or Miocene, beds, chiefly occupying the higher tracts. Rainwater falling upon this superficial sponge soon penetrates beyond the influence of

active evaporation, and on reaching the up-turned edges of the older beds trickles in at every pore and crevice surcharging the same to great depths. We have thus formed at considerable altitude an internal cistern, as it were, which has only to be tapped, naturally or artificially, at a lower level to obtain an overflow. In this case, to reach the contents of the subterranean reservoir, nature has excavated the deep valleys of Gould's, Little Garden, and Tenafeat Creeks nearly in parallelism with the strike, and on the dip side of the fundamental rocks. These geological features would naturally lead the geologist to conclude that all, or nearly so, of the outflow would be by these channels. It is not so, however; the deep, transverse chasms of Smith's Creek and Spring Gully have effected an outlet direct to the west, by which by far the greatest outflow takes place. Indeed I might almost venture to say that the permanent supply to these creeks is not to be surpassed for the given area by any other in South Australia. On the map I have indicated the sites of the springs, all of which flank the heights overlaid by the Upland Miocene beds.

Soils.

The soils in Munno Para partake much of the character of the beds on which they rest. Therefore, throughout the uplands, the character of the soil might be taken as a pretty sure index to the kind of rock below. Where a stiff clay soil prevails the bed-rock will consist chiefly of clay-slate. When the soil is more friable and loamy, the underlying slate is probably interbedded with a band of fundamental limestone giving a more pulverous character to the soil, and this is in my opinion one of the chief sources of our crust limestone or travertine. This description of soil, though probably not so inexhaustible, is in the virgin state more fertile than those overlying the Drift. The soils formed from the *debris* of the quartzites and Upland Miocenes are generally of a coarse sandy character, and are less enduring than either of the above.

Finally, I beg to direct attention to patches of subsoil occurring in protected spots at high altitudes, which at first sight might readily be mistaken for outliers of the true Drift series. A little investigation of the imbedded material and comparison with that from the natural surroundings, from whence it might reasonably be expected to have been derived, has invariably led me to the conclusion that it is merely the product of a comparatively recent subaerial wash from the adjoining slopes.

Vegetation.

Thirty years ago the prevailing indigenous grasses of Munno

Para were the Speargrass, Kangaroo grass, and a few others now long since extinct. As cultivation progressed, the first to invade these native forms were the Canarygrass and Wild Oat; afterwards the Barleygrass, and lastly the Silvergrass and Cape-weed.

Native Flax, in the early days, was a common plant throughout the lower tracts, and the common Grass-tree also found a favourite station on some of the soils derived from the waste of the quartzite bands.

In the arboreous class much greater diversification prevailed. The characteristic trees inhabiting the quartzite soils were the Sheaoak, Poison-berry tree, an occasional Native Cherry-tree, Wattle *(Acacia pycnantha)*, and Peppermint. As the situation approached the higher altitudes and partially occupied by the Upland Miocene, the latter give place to varieties of the Blue Gum and White Gum. The alluvial flats of Gould's, Little Garden, and Tenafeat Creeks and their tributaries, and the sources of Smith's Creek, were the favourite stations of the Red Gum, in some cases sustaining those trees to wonderful sizes.

Soils derived from and immediately overlying the clay-slate and marbles, for the greater part produce Wattles, chiefly the black variety, which are indigenous to the soils of the Drift also.

The arboreous plants originally inhabiting the lower tracts (Peachy Belt) were large Peppermint, Mallee, Pine, Native Peach, and a vast variety of shrubs, which have all, or nearly all, become extinct since the advent of modern husbandry,

Conclusion.—If these lines—I don't flatter myself they are faultless—tend to create a greater interest in the minds of our inhabitants towards the development of South Australian geology, I have attained the chief object that prompted me to devote many a spare hour in collecting the ground-work upon which the remarks are based, fully intending to extend the sectional line across the Schist formations of the Barossa Ranges to the newer Miocene beds of the Murray Plateau.

Having so far completed—though I am afraid imperfectly—a self-imposed task, it now devolves upon me to acknowledge my indebtedness to those I have found ready to assist in my labours in the field, especially to Mr. John Alexander, Mr. Alexander Adams, Mr. Robert Paterson, and pre-eminently to Professor Tate, of the Adelaide University. To the last named gentleman I am not only indebted in an especial manner for his labours and valuable practical suggestions in the field, but also for arranging the subject matter of the foregoing lines into greater conformity with scientific requirements.

EXPLANATION TO PLATES.

Plate V. Geological map of the eastern half of the Hundred of Munno Para. Scale, one inch to a mile.

Plate VI. Fig. 1. Diagrammatic section of about twenty chains in gully passing through Sections 4,166 and 4,155.

Fig. 2. Horizontal Section from Railway Station at Smithfield, bearing E. 14° S. into the Hundred of Para Wirra. Datum line, 160 feet above low-water mark. Horizontal scale, three inches to one mile; vertical scale, quarter-inch to 100 feet.

Plants Indigenous to the Neighbourhood of Hermannsburg,

on the River Finke, Central Australia.

By the Rev. J. Kempe, Missionary.

[Communicated by Baron F. von Mueller, K.C.M.G., F.R.S., &c., Hon. Memb.]

[Read October 5, 1880.]

Introductory Note by Baron F. von Mueller.—I had named the species of the following list of plants from Mr. Kempe's successive collections. As a constituted whole it gives a good idea of the vegetation of the mission locality. Next year a second list will be given. Mr. Kempe writes—"If rain should fall in summer, then nearly all species of flowering plants, even most of the shrubs, commence to blossom a second time. The maximum temperature is in the shade 120° F., and the minimum is 27° F."

DICOTYLEDONOUS PLANTS.

Cruciferæ.

Lepidium papillosum, F. M.; *L. phlebopetalum*, F. M.; *L. ruderale*, Linné. All annuals, widely dispersed over the whole country, and blooming in August.

Stenopetalum nutans, *F. M.*; an annual.

Erysimum lasiocarpum, *F. M.*; an annual, growing in shady places only, particularly under shrubs; flowers in August.

Capparideæ.

Capparis spinosa, Linné and *C. Mitchelli*, Lindley; both perennial shrubs. The latter attains to a height of 10 to 12 feet, whilst *C. spinosa*, the true caper-plant, is a somewhat trailing shrub, growing up and near the ranges, even on the most arid and deserted places. The month of November is the usual time of blooming, but *C. spinosa* is blooming and bearing fruit nearly all the year, even in winter.

Cleome viscosa, Linné, is annual, which grows only on stony places.

VIOLACEÆ.

Hybanthus aurantiacus, F. M. A low perennial, growing mostly on calcareous soils, even on barren limestone hills; it flowers nearly the whole summer.

STERCULIACEÆ.

Melhania incana, Heyne; a small shrub, widely dispersed.

Commersonia sp., grows on the sandhills, where it keeps green all the year.

Waltheria indica, Linné. This low perennial is confined to the Glen of Palms.

MALVACEÆ.

Hibiscus microlœnus, F. M. A shrub attaining the height of four to six feet. It grows on the most arid places on the hills, and blooms, with yellow flowers, nearly the whole summer.

Gossypium Sturtii, F. M. Grows mostly everywhere in the sandhills.

Abutilon Fraseri, Hooker. This plant is growing almost anywhere, whilst

A. tubulosum, Hooker, is only to be found here in the ranges.

Sida corrugata, Lindl. A perennial widely spread over the country.

Malvastrum spicatum, A. Gray. This annual grows also everywhere, but best on calcareous soil among and under the shade of larger shrubs.

Lavatera plebeja, Sims. An annual which attains the height of six to eight feet. It grows only in the river-beds and in swampy ground.

EUPHORBIACEÆ.

Adriana tomentosa, Gaudichaud. Perennial, and growing mostly in the river-beds and near all creeks.

Phyllanthus rhytidospermus, F. M. Annual, growing only in shady places in the ranges.

Euphorbia Drummondi, Bois, and *E. eremophila*, Cunn., are annuals spread all over the country around here.

URTICACEÆ.

Parietaria debilis, Forst.; an annual growing in the ranges.

SAPINDACEÆ.

Atalaya hemiglauca, F. M. This plant grows here only in the ranges, even on bare rocks.

Dodoœna vicosa, Linné, and *D. lanceolata*, F. M., are shrubs, flowering in August. The former flourishes the most on sandy soils, whilst the latter grows only within or near the ranges.

TILIACEÆ.

Corchorus sidoides, F. M. A small perennial shrub, flourishing best on calcareous soils.

GERANIACEÆ.

Erodium cygnorum, Nees. An annual growing only in shady places within the ranges; flowers can be seen all the summer.

Oxalis corniculata, Linné. This annual grows only after rains in the beds of creeks.

ZYGOPHYLLEÆ.

Zygophyllum apiculatum, F. M.; *Z. ammophilum*, F. M.; *Z. fructiculosum*, Cand. The two first are annuals, and, here, the first messengers of the coming spring. The three are disposed all over the country around here, and will grow on the driest sandy soil.

PHYTOLACCACEÆ.

Gyrostemon ramulosus, Desf. A shrub growing on limestone hills, and in general on stony ground.

Codonocarpus cotinifolius, F. M. A tree attaining the height of 20 to 30 feet; it seems to prefer the most deserted places, as it is only to be found either on sandhills or on rocky ground.

CARYOPHYLLEÆ.

Polycarpæa corymbosa, Lam. An annual growing on stony ground.

PORTULACCÆ.

Claytonia Balonnensis, Lindl., and *C. corrigiolacca*, F. M., are annuals, and grow almost everywhere here, provided the soil is not too dry.

AMARANTACEÆ.

Euxolus Mitchelli, F. M., an annual growing on stony tracts.

Ptilotus nobilis, F. M. This annual is only growing here on rich soil in the ranges; whilst

P. obovatus, F. M., and *P. helipteroides*, F. M., can be seen almost everywhere, particularly on sandy plains.

Alternanthera triandra, Lamarck.

CHENOPODIACEÆ.

Rhagodia spinescens, R. Brown. A shrub growing only in shady places, particularly among dense bush.

Chenopodium carinatum, R. Br. An annual spread all over the country.

Dysphania plantaginella, F. M. An annual; it grows only in rich and moist soil, particularly in swampy places.

Enchylæna tomentosa, R. Br., is widely dispersed.
Chenolea diacantha, F. M. A small annual growing on stony ground; sheep feed well upon it.
C. paradoxa F. M., grows almost everywhere.
Kochia villosa, Lindl., grows mostly on calcareous soils; whilst
K. eriantha, F. M., can be seen everywhere. Sheep feed well on both species.
Salsola Kali, Linné. An annual which attains an enormous size.

NYCTAGINEÆ.

Boerhaavia diffusa, Linné. Grows here only in the Glen of Palms, and is perennial.

LEGUMINOSÆ.

Brachysema Chambersi, F. M. A perennial; it grows here only on the sandhill on Rudall's Creek. The natives eat the flowers of it.
Isotropis atropurpurea, F. M. Annual growing everywhere.
I. Wheeleri, F. M. Perennial, growing on sandy soil in general, mostly on sandhills.
Crotalaria Cunninghami, R. Br. Growing even on the most arid tracts.
C. medicaginea, Willd. Grows only on rich soil; whilst
C. dissitiflora, Benth., will grow even on the white sand of the creeks.
Lotus australis, Seringe. Annual, and growing mostly on sandy soils.
Psoralea patens, Lindl. Perennial, and spread all over the country.
Indigofera linifolia, Retzius. Annual, growing only in rich loamy ground.
I. viscosa, Lam., and *I. enneaphylla*, Linné, are both annuals of rich clayey soil.
I. brevidens, Bentham. A shrub, growing here only in the ranges.
Tephrosia purpurea, Pers., on stony ground.
Rhynchosia minima, De Cand., is a creeping perennial growing in stony places.
Glycine clandestina, Wendl. Perennial, grows on sandhills.
Cassia pleurocarpa, F. M. A shrub, grows on sandy soil.
C. sophera, Linné, is an annual flourishing best in river beds.
C. glutinosa, Cand. A shrub growing on rocky tracts.
C. desolata, F. M.
C. artemisioides, Gaudich.
C. eremophila, Cunn.
} All shrubs, growing in all deserted places.
Petalostylis labicheoides, R. Br., a little shrub growing on limestone hills and the ranges.

Acacias, all phyllodineous, are here in a vast number of species, but their names shall follow next year.

HALORAGEÆ.

Haloragis Gossei, F. M. An annual, growing all about.

MYRTACEÆ.

Calycothrix longifolia, F. M.

Melaleuca glomerata, F. M.; *M. parviflora*, Lindl. Shrubs growing almost everywhere.

Eucalyptus pachyphylla, F. M.; *E. gamophylla*, F. M.; and *E. oleosa*, F. M.

PROTEACEÆ.

Grevillea Sturtii, R. Br., in the ranges; *G. angulata*, R. Br.

Hakea lorea, R. Br.; Glen of Palms. *H. leucoptera*, on loamy plains. Several other kinds of Protaceous plants exist here.

THYMELEÆ.

Pimelea trichostachya, Lindl. A small perennial growing on stony rises.

SANTALACEÆ.

Santalum lanceolatum, R. Br.

UMBELLIFERÆ.

Didiscus glaucifolius, F. M. } Both annuals, growing here only
Daucus brachiatus, Sieb. } on rich but loose soil.

RUBIACEÆ.

Canthium latifolium, F. M. A tall shrub, growing on stony ground, particularly in the ranges. Its sweet berries are the favourite eating of the natives here.

COMPOSITÆ.

Of this order a vast number of species exist here; some only are given. Several are good for sheep as well as for cattle and horses.

Aster subspicatus, F. M., and *A. Ferresi*, F. M., are not restricted to any particular tract.

Vittadinia australis, Rich., grows on sandy soil.

Podocoma cuneifolia, R. Br. An annual growing on limestone hills only.

Calotis lappulacea, Benth.; *C. hispidula*, F.M. Annuals, on sandy soils.

Pterocaulon Billardieri, F. M. A perennial, flourishing mostly on limestone hills.

Pluchea Eyrea, F. M. Annual, widely dispersed here.

Pterigeron microglossus, Benth. Perennial, growing on sandy tracts. It has very lovely flowers.

Wedelia sp. A perennial shrub growing in the ranges and stony places in general.

Glossogyne tenuifolia, Cass. Annual, on sandy soil.

Angianthus sp. An annual, growing only in swampy places.

Rutidosis helichrysoides, De Cand. An annual flourishing mostly on limestone hills. It is spreading rapidly.

Ixiolæna tomentosa, Sond. and F. M. A perennial, growing everywhere.

Podolepis canescens, Cunn. A small annual, growing only on sandhills.

Helichrysum Cassinianum, Gaud. Annual, growing the most luxuriantly amongst dense mulga-shrubs.

H. Lawrencella, F. M.; an annual, in shady and moist places.

H. lucidum, Henckel. Annual, spread over the whole country, but the lovely flowers develop their beauty only in the most deserted tracts.

H. apiculatum, Cand. Annual or biennial, growing anywhere. Horses are extremely fond of it.

H. Thomsoni, F. M.; an annual growing only in shady places in the ranges.

Helipterum floribundum, Cand. Annual; rich loamy plains are after rains quite covered with its flowers.

H. stipitatum, F. M.; this annual plant with its lovely flowers exists here only in the sandhills.

H. incanum, Cand. Perennial, growing on stony, even very arid ground.

H. Tietkensi, F. M.; this annual is growing almost everywhere.

Gnaphalium luteo-album, Linné. An annual growing in or near creeks.

Erechthites picridioides, Turcz. An annual, in moist sand of the river beds, flowering nearly the whole summer.

Senecio Gregorii, F. M.; an annual, blooming early in spring, and growing everywhere, even on poor sandy soil; whilst

S. magnificus, F. M., grows only on limestone hills.

Campanulaceæ.

Isotoma petræa, F. M.; an annual, on rocks; very poisonous, but avoided by stock.

Wahlenbergia gracilis, De Cand. An annual, growing very densely on the plains. There are two varieties here, one with large flowers, and the other with very small ones.

Goodenoviaceæ.

Leschenaultia divaricata, F. M.; an annual, dispersed all over the country.

Velleia connata, F. M.; an annual, on limestone hills; it possesses a tonic bitterness.
Goodenia Rameli, F. M.; on the ranges; whilst
G. Mueckeana, F. M., is only to be found on sandhills.
Scævola parvifolia, F. M.; an evergreen perennial, growing in all deserted places.
Brunonia australis, Smith. An annual, in sandy regions.

GENTIANEÆ.

Erythræa australis, Br. Annual, grows in the sand of the river beds; a good tonic herb, not touched by pastoral animals.

PRIMULACEÆ

Samolus repens, Pers. Growing generally near the water.

JASMINEÆ.

Jasminum lineare, R. Br. A shrubby plant.
J. calcareum, F. M.; also perennial, and growing in the ranges.

APOCYNEÆ.

Carissa Brownii, F. M., var. *angustifolia*, is confined to the Glen of Palms. The flowers are white, and appear in June; the leaves are of a lively green.

ASCLEPIADEÆ.

Sarcostemma australe, R. Br.
Cynanchum floribundum, R. Br. In sand of the creeks.

SOLANACEÆ.

Solanum esuriale, Lindl. Perennial, on sandy soil.
S. Sturtii. A shrub six to eight feet high in the ranges.
S. ellipticum, Br. Herbaceous, growing on rich clayey soil, and also in the ranges.
Nicotiana suaveolens, Lehm., (Native tobacco), grows in the moist sand of river beds, and attains an enormous size.

SCROPHULARIACEÆ.

Stemodia Morgania, F. M.; spread all over the country.

ACANTHACEÆ.

Justicia procumbens, L. A small shrub, growing everywhere, especially in limestone country.
J. Kempeana, F. M.; a dwarf perennial.

BIGNONIACEÆ.

Tecoma australis, Br. A somewhat creeping shrub, growing in the ranges.

CONVOLVULACEÆ.

Breweria rosea, F. M. A perennial, blooming in August, flowers violet, of great beauty.

Evolvulus linifolius, L. A small annual, growing in the ranges.

BORAGINACEÆ.

Heliotropium curassavicum, L., and *H. asperrimum*, Br. Annuals, growing on stony ground.

Halgania cyanea, Lindl. Perennial, grows on the top of the ranges, as well as on sandhills.

Trichodesma Zeylanicum, Br. A tall annual, growing mostly on stony ground, and blooming nearly all the year. The delight of the dromedaries.

Cynoglossum Drummondi, Benth. Annual, growing everywhere.

LABIATÆ.

Prostanthera striatiflora, F. M. A shrub growing on rich plains.

P. Baxteri, Cunn. A variety of this grows in shady places only in the ranges. It is a shrub six to eight feet high, with white flowers, and very small leaves of a whitish hue.

VERBENACEÆ.

Dicrastyles Lewellini, F. M. A perennial of very dense growth, flowers blue, leaves of a whitish hue; it is widely spread in the sandhills.

MYOPORINÆ.

Eremophila Macdonnelli, F. M. A trailing shrub; it grows everywhere.

The following are all shrubs, not restricted in habitat, growing nearly everywhere, but mostly in the ranges :—

E. Willsii, F. M.; *E. Brownii*, F. M.; *E. Sturtii*, Br.; *E. Latrobei*, F. M:; and *E. Freelingi*, F. M.

CASUARINEÆ.

Casuarina Decaisneana, F. M., on sandhills.

CYCADEÆ.

Encephalartos Macdonnelli, F. M., in the ranges.

CONIFERÆ.

Callitris verrucosa, R. Br., only in the ranges.

MONOCOTYLEDONOUS PLANTS.

PALMÆ.

Livistona Mariæ, F. M. Along the Finke River and some of its small tributaries.

JUNCACEÆ.

Xerotes leucocephala, R. Br.

GRAMINEÆ.

Andropogon sp., perennial confined to the ranges.
Pappophorum commune, F. M., annual, only in the ranges.
Festuca irritans (the Spinifex of colonists); is the real plague of the country; it grows everywhere.

ACOTYLEDONOUS PLANTS.

FILICES.

Cheilanthes vellea, F. M., perennial, growing on rocks only.

DIAGNOSES OF

NEW SPECIES OF PLANTS DISCOVERED IN SOUTH AUSTRALIA.

Translated and communicated by STIRLING SMEATON, B.A., Associate.

[Read October 5, 1880.]

Justicia Kempeana. F. v. M., Fragmenta Phytographiæ Australiæ, vol. xi., p. 101. (Ord. Acanthaceæ).

Very thinly pubescent, herbaceous, *leaves small, circular or obovate and wedge-shaped, crenately dentate*, or almost entire; *flowers axillary solitary*, or more rarely almost sessile in twos and threes; bracts herbaceous, leaf-like; calyx five-cleft, below narrow-lanceolate, above lineas-subulate, the lips of the projecting corolla about double the calyx and equal to its own tube; the lower lip shortly trifid; the stamens projecting from the throat of the corolla, one cell of the anthers shortly spurred, the style and ovary smooth; capsule much stipitate; seeds warty and rough.

Near the MacDonnell Range—Rev. H. Kempe. In the neighbourhood of the Ashburton River and between the Gascoyne and Murchison Rivers—E. Giles.

A perennial herb, one foot and a half high, or shorter. Branches thickly covered with appressed hairs. Leaves shortly petiolate, oblong, and wedge-shaped; upper ones

sometimes narrow lanceolate, three to six lines long, and occasionally nine lines. Two opposite bracts one and a-half to three lines long (in the narrow-leaved variety longer and linear-lanceolate). Calyx about one quarter inch long. Corolla rose-tinted; upper lip almost semi-ovate, very shortly and bluntly two-toothed, or nearly entire; the lobes of the lower lip bluntly rounded, the middle one broadest; the tube with the lower lip slightly crested in two longitudinal folds, below, the cresting doubly barbed, from which arise small folds ascending to the upper lip, indicating possibly two suppressed stamens; the middle lobe of the lower lip outside in the bud; the upper lip inside before unfolding; æstivation imbricate, not contorted. Stamens two, with smooth slender filaments slightly thickened above. Anthers smooth, coherent for a time; the free lobe oblique and somewhat the higher, the spur of the lower lobe pale and nearly membraneous, narrow, and almost acute. Style hairlike, smooth, nearly half an inch long. Stigma very small, semi-ovate. Disc cup-shaped, sinuate-dentate. Ovary four-celled; gemmules both superior. Capsule five to six lines long; the seedless base a little shorter than the hollows of the cells. Seeds brown, round, a little more than one line across, with flattened prickly rugosities, half surrounded by an acute retinaculum.

From the neighbouring species of *Justicia hygrophila* it is chiefly separated by its shorter and almost shrubby stem, greater hairiness, smaller leaves (often toothed), leafy bracts, the often solitary flowers, corollas more evidently hairy on the outside, and (as to the variety with narrow bracts) the longer stalked capsule; and, finally, the seeds more warty than granulated with the thickened edge.

Flowers in August and September, and prefers a limy soil.

Schœnus Tepperi. F. v. M.; loc. cit., p. 106. (Ord. Cyperaceæ).

Very dwarf, stem very short, one-spiked, much exceeded by the very narrow-chanelled leaves; lowest bracts produced into a long narrow leafy appendage; the other bracts few, membranous, with a rather wide margin; *a single fertile flower;* no hypogynous bristles; seed vessel three-cornered, obovate, pale in colour, striated longitudinally with three narrow folds.

Yorke's Peninsula—Otto Tepper.

Plant forms tufts. Leaves for the most part from one to one and a-half inches in length, barely one-third line in width, beardless, a little rough at the edge. The flowerless part of the stem scarcely equal in length to the peduncular spikelet. Bracts besides the leafy point two and three lines long; the upper ones narrow but rather obtuse. Stem hollowed out or

curved for the reception of the solitary fruit. Stamens unseen as yet by me. Style two to three lines long, thin and bristle-like. Stigmas three, hairy, a little shorter than the style. Seed vessel two-thirds of a line long.

This species approaches *Schœnus trachycarpum*, but differs from it in its extraordinary dwarfness, shortened peduncle, shorter bracts below the involucre, longer and more membraneous floral bracts, less wrinkled fruit, and no more than a single fertile flower, in which last characteristic it differs from all its congeners hitherto known.

Battarrea Muelleri. Kalchbr. (M.S.); F. v. M., loc. cit., p. 106. (Fungi).

Whitish; inner peridium campanulo-mitrate; *stalk* solid, *very long, chaffy, and scaly*, thickened by degrees above; the chaff-like scales linear lanceolate directed downwards, almost imbricate; spores globose, warty, of a rusty colour, with short filaments, almost spiral, placed between the spores.

In the neighbourhood of Spencer's Gulf—O. Tepper.

A noteworthy species of a remarkable genus.

Stem nine or ten times longer than the breadth of the cap. External peridium hitherto unknown. Spores ·004mm. across.

On the Australian Tertiary Palliobranchs.

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Plates VII.—XI.

[Read October 5th, 1880.]

Bibliography.—Among the fossils collected by Captain Sturt during his journey down the River Murray, and figured in his work "Two Expeditions into the Interior of South Australia," 1834, is one terebratulid. The shell has been described and variously named by subsequent authors, and is referred to in this paper as *Waldheimia Garibaldiana*, Davidson. Mr. G. B. Sowerby, in Count Strzelecki's "Physical Description of New South Wales and Van Diemen's Land," 1845, describes and figures a second palliobranch as *Terebratula compta*, which I have removed to the genus *Magasella*. In 1862 Mr. Davidson described Sturt's terebratulid in the "Geologist," vol. v., under the name of *Waldheimia Garibaldiana*, at that time believing it to be from the Tertiary beds of Malta. In the same year appeared the Rev. J. E. Tenison Woods' "Geological Observations in South Australia," in which Sturt's terebratula is confounded with *T. compta*, Sow.; but in the "Trans. Phil. Soc., Adelaide," for 1865, he figures and describes it as a new species under the name of *Waldheimia imbricata*. In the same paper Mr. Woods describes *Waldheimia gigas*, *W. Crouchii*, and shows that *Terebratula compta* belongs to *Terebratella*, in which genus he describes a second species as *T. Tenisoni*. Additional species are made known by Mr. R. Etheridge, jun., in a paper entitled 'On some Species of Terebratulina, Waldheimia, and Terebratella from Mount Gambier and the Murray River Cliffs." (Annals and Mag. of Nat. Hist., 1876). Of the five species herein described and figured:—*Waldheimia Gambierensis*, which is identical with *W. grandis*, Woods, and *W. Garibaldiana*, were previously known; a *Terebratella* is erroneously referred to *T. compta*, it is a species closely allied to the recent *Magasella Cumingiana*, I have named it *M. Woodsiana*. The remaining two species, *Waldheimia Taylori* and *Terebratulina Davidsoni*, are decidedly new.

The Rev. J. E. Tenison Woods describes and figures (Trans. Roy. Soc., N.S.W., 1878) some palliobranchs from the Miocene

beds at Table Cape, Tasmania, collected by Mr. R. M. Johnston. Unfortunately the species are very inadequately illustrated; and also because of the very brief characters given, it is almost impossible to understand the species. However, I have been favoured by Mr. Johnston with the loan of the very excellent drawings of the original specimens, and of some specimens named from the types. The species represented are, so far as I can judge, *Waldheimia Garibaldiana*, and the previously undescribed *Terebratula vitreoides*, *Waldheimia Tateana*, and a species erroneously referred to *W. Corioensis*, McCoy. The last may be a *Terebratella;* it is unknown to me. An undescribed *Rhynchonella* is also referred to in the text. Professor McCoy, in the "Fifth Decade of the Palæontology of Victoria," 1877, figures and describes a new and remarkable *Waldheimia* as *W. Corioensis*, and adult forms of *W. Garibaldiana* under the name of *W. macropora.*

From these sources nine species have been well established, and the existence of three or four others are indicated. Adding to these the species now described for the first time, the total number of palliobranchs from the Australian Tertiaries is 33, generically distributed as follows:—Terebratula, 4; Waldheimia, 15; Terebratulina, 4; Terebratella, 4; Magasella, 4; Thecidium, 1; and Rhynchonella, 1.

Localities and Horizons.—The surpassing richness in palliobranchs of most fossiliferous localities in South Australia is imperfectly indicated by the fact that all the above species, excepting *Terebratella Woodsii* and *Thecidium australe*, have been collected within the province. My experience as a collector beyond the limits of the colony is limited to the Muddy Creek beds, near Hamilton, Victoria. In many of the sections the profusion of palliobranchs and echinoderms recalls a feature of the Jurassic formations. Their generally good state of preservation, and the comparative facility with which the interiors can be dissected out, have enabled me to discriminate species with a much greater degree of confidence than is usually possible. Indeed, no criterion as to generic position can be drawn from the external characters alone. Thus, without a knowledge of the interior of *Terebratula Aldingæ*, that shell might very well have been referred to *Waldheimia*, if not indeed associated with *W. insolita.* Again, the external characters by which *Terebratella furculifera* is separable from *W. insolita* are so trivial in themselves, though nevertheless practical tests, that one might well hesitate to regard them of specific value. In consequence of a mimetic resemblance among some species in different genera, I have hesitated to assign to its genus any species whose interior characters have not been ascertained. In such cases of

uncertainty the generic name employed has a note of interrogation affixed.

The uppermost set of marine fossiliferous beds of the South Australian Tertiaries is almost devoid of palliobranchs; and only in one locality—near Morgan, on the River Murray—have specimens been gathered in a sufficiently good state of preservation for accurate determination. The superior beds of the River Murray cliffs, or Upper Murravian, I have elsewhere endeavoured to prove are contemporaneous with the celebrated fossiliferous strata of Muddy Creek, in Victoria. In both of of them the palliobranchs are all of small size, and are for the most part dwarfed examples of species which have passed up from lower horizons. The species in common are *Waldheimia Garibaldiana*, *W. Tateana*, and *Terebratulina Scoulari*, all rare and small. The Muddy Creek beds have yielded in addition—*Terebratulina Davidsoni*, very rare and small; *Magasella Woodsiana*, small form, though not rare; *Rhynchonella squamosa*, very rare; *Thecidium australe* and *Waldheimia Corioensis*, rare. In the basal beds of the Upper Murravian, about Blanchetown, a large *Waldheimia (W. MacLeani)* is profusely abundant.

The Middle Murravian beds contain *Terebratulina Scoulari*, *Waldheimia gigas*, and *W. Garibaldiana* in great abundance.

The Lower Murravian beds of the northern section of the Lower Murray cliffs have not yielded any examples of the class, except *Magasella Woodsiana*, at one locality only (Moorundi, near Blanchetown), where it occurs in great plenty and of large size. But in the cliffs about Mannum and on the River Bremer palliobranchs occur in great variety and abundance. The commoner forms are *Terebratulina Davidsoni*, *Magasella compta*, *M. Woodsiana*, and *Waldheimia* (?) *divaricata*.

In correlated beds we have in the white limestone at Mount Gambier *Magasella Woodsiana* and *Terebratulina Davidsoni* in abundance; and in the yellow Polyzoal calcareous sands of Aldinga Bay *Magasella Woodsiana*, var., and *Waldheimia furcata* of infrequent occurrence. The Table Cape beds, Tasmania, are probably not older than the above series; and though the class is represented in them by seven species, yet individuals seem to be rare.

Descending in the scale of our Tertiary deposits we encounter in the glauconitic limestones of the cliffs in Aldinga Bay, and in their probable representatives on the opposite shore of St. Vincent's Gulf, and in the chalk of the Bunda Cliffs in the Great Australian Bight, a palliobranch fauna with a facies very distinct from that of higher horizons. The total number of species collected from them is twenty-one, or seven-elevenths of the known Australian Tertiary species. Of these fifteen do not pass to higher stages of the formation. Many of the

species occur in abundance, such as *Waldheimia pectoralis*, *W. sufflata*, *Terebratulina lenticularis*, and *Terebratula subcarnea; Waldheimia Tateana*, which is profusedly abundant, *Terebratula vitreoides*, *Terebratulina Scoulari*, and *T. Davidsoni* occur here of a much larger size than in the higher beds to which they pass up.

In an appended table I have set forth the stratigraphical and geographical distribution of the species.

Alliances.—The facies of our Tertiary palliobranch fauna is, so far as regards genera, most decidedly modern; but the specific points of contact are few. They are notably *Terebratula vitreoides*, *Waldheimia Garibaldiana*, *Terebratulina Scoulari*, *Magasella Woodsiana*, *Thecidium australe*, and *Rhynchonella squamosa*. Nevertheless, not one of the fossil forms is actually known to be represented in living creation. Of the above *T. vitreoides* and *Th. australe* are related to living Mediterranean species, whilst the others have near recent allies in the Australasian region. On the other hand, the great richness in species of *Waldheimia*, more than half of which are of exceedingly large size, gives to the faunula a character peculiarly its own. The presence, moreover, of several biplicated species of that genus is another fact which increases the contrast between our Tertiary and living palliobranch faunas.

A general resemblance seems to subsist between our Tertiary species and those of the European Miocene; but if the Terebratulæ of the latter are correctly so assigned, then the resemblance is in part at least mimetic rather than actual. Thus *Waldheimia grandis* approaches *Terebratula Pedemontana; W. insolita* to *Terebratula Hilarionis;* and other similitudes might be pointed out.

The absence of the genera *Megerlia*, *Platidia*, and *Argiope* from our Tertiary fauna, also the paucity of *Rhynchonella*, and the presence of *Magasella*, offer great difficulties to the establishment of any well-defined relationship between the European and Australian Tertiary palliobranch faunas. If we select *Terebratula subcarnea* and the Terebratulinas (excepting *T. Scoulari)*, we might, as equally well, claim for the Australian Tertiary palliobranch fauna a Cretaceous facies.

Viewed in its entirety our Tertiary palliobranch fauna has as much a character of its own, as it has affinity with that of the European Caniozoic or to that of recent Australia. But viewed in its duality, then the older is seen to be far removed from recent types, whilst the newer is seen to possess more pronounced affinities with members of the class inhabiting the seas around and adjacent to this continent. In respect to the older fauna, it may be well to recall the fact that two at least of its species (*Waldheimia insolita* and *Rhynchonella squamosa)* are constituents of the fauna of the Upper Eocene

of New Zealand; and I have reason for the opinion that when a careful comparison shall have been instituted between the fossils of the Eocene of New Zealand and those from the Aldinga beds great specific identity will be found to obtain.

Description of Species.

Terebratula vitreoides, T. Woods. Plate viii., fig. *5a 5b*. Plate x., figs. *7a—7b*.

Ref.—Trans. Roy. Soc. New South Wales, 1878, p. 78, figs. *4a—d*.

"A small, smooth, orbicular species, with very conspicuous concentric lines of growth. Foramen small. Of this fossil Mr. Davidson says—'This is another of those undecided forms that resemble many things described as distinct species. It has some resemblance to *T. vitrea* or to *T. orbicularis*, Sequenza, I would not like to assign it positively to any species, although I would not assign to it any very distinguishable features.'"—*T. Woods.*

The specimen which I have figured Plate viii., fig. 5, under the above name is one of a small series from the lower beds at Aldinga, agreeing very well with Woods' description and figures, except that the foramen is usually larger. Of the Aldinga examples I have not been able to dissect out the interior; but somewhat similar shells from the River Murray cliffs prove to have the loop of a *Terebratula*, see plate x., fig. 7. Of the latter I have only been successful in collecting three examples, all of which are smaller than the Aldinga specimens, and differ in being more gibbous with depressed sides, and in having a smaller foramen, characters which approximate it more to *T. vitrea*, Born., whilst the Aldinga specimens make an approach to *T. elliptica*, Sequenza. The differences, which may be due to age, are too slight to justify the specific separation of the two forms.

The loop of *T. vitreoides* differs from that of *T. vitrea* in being relatively shorter and stouter, the breadth of the curved front portion is much greater, and the crural processes are inconspicuously developed.

Dimensions.—A large specimen from Aldinga has the following measures:—Length, 1·45; breadth, 1·05; thickness, ·7 inch. One from the Murray cliffs:—Length, 1·0; breadth, ·8; thickness, ·5 inch.

Locality and Horizon.—Lower Aldinga—glauconitic limestones, Blanche Point, Aldinga Bay; and Middle Murravian, calcareous sands at Blanchetown. (Tate).

Table Cape, Tasmania. (R. M. Johnston).

Terebratula Aldingæ, *spec. nov.* Plate x., figs. *2a—2b*.

Shell obtusely five-sided; a little longer than wide; broadest

about the anterior third ; straight or slightly indented in front. Valves moderately convex, the brachial valve more depressed. Surface marked with inequidistant concentric imbricate lamellæ of growth. Punctations of test not visible under a pocket lens, except in thin sections when viewed by transmitted light ; punctations minute, widely separated. Beak small incurved and obliquely truncated by a small oval foramen, separated from the umbo of the brachial valve by a small triangular deeply impressed deltidial plate (elements not distinguishable). Interior without a medial septum ; of the loop the part posterior to the crura only known. These portions are longer, more slender, and less divergent than in *T. vitreoides*.

Dimensions.—Length, ·9 ; breadth, ·75 ; thickness, ·45 inch.

Obs.—Young examples of this terebratulatid and *Terebratella furculifera* closely resemble each other, but the latter is at once known by its densely punctated shell structure and foramen. From *Terebratula vitreoides* it differs especially in its nearly flat brachial valve and pentagonal shape.

Locality and Horizon.—In the glauconitic limestones, north side of Blanche Point, Aldinga Bay. (Twelve examples).

Terebratula (?) **subcarnea**, *spec. nov.* Plate ix., figs. 1*a*—1*b*.

The interior of this species is not known, and the external characters which belong to *Waldheimia* are not presented by it. It so closely resembles *T. carnea* of the European Cretaceous rocks, that it is only after very careful comparison with many specimens of that species that differences are found to exist. *T. subcarnea* has a larger, though small, foramen ; the brachial valve is not so gibbous ; and its greatest breadth is nearly medial. These characters partly serve to separate it from *T. carneoides*,* Guppy, of the Antillian Miocene, to which must be added that the front margin of our shell is either straight or slightly depressed.

Dimensions of a large specimen :—Length, 1¾ inches nearly ; breadth, 1½ inches ; thickness, 1 inch nearly.

Locality and Horizon.—In the top-bed of chalk, Bunda Cliffs, Great Australian Bight. (For the geology of, see vol. ii. p. 104, of this Society's Transactions).

Terebratula (?) **bulbosa**, *spec. nov.* Plate vii., figs. 5*a*—*b*.

Shell ovate, longer than wide, rounded laterally and attenuated towards the narrow, nearly straight, slightly crenulated front.

Brachial valve very convex, slightly depressed near the

* Quart. Journ. Geol. Soc., London, vol. xxi., t. 19, fig. 3, p. 296, 1866 ; and Davidson, Geol. Mag., 1874, t. 8, fig. 11, p. 158.

front; interior unknown. Peduncular valve as deep as the opposite valve; beak large, incurved, and obliquely truncated by a large obovate foramen.

Surface smooth, marked by moderate lines and striæ of growth.

Dimensions.—Length, 1·8; breadth, 1·35; thickness, 1·3 inch.

Locality and Horizon.—In the coarse limestones forming the low sea-cliff on the south side of the jetty at Edithburgh, Yorke's Peninsula. (One example).

Waldheimia Garibaldiana, Davidson. Plate xi., figs. 1*a*—1*c*.

Ref.—Geologist, vol. v., p. 446, t. 24, f. 9, 1862.

Id. R. Etheridge, jun., Ann. and Mag. Nat. Hist., vol. 17, p. 17, t. 1, f. 2, 1876.

Syn.—Terebratula sp., Sturt. Two Expeds. in S. Aust., vol. ii., t. 3, f. 15, 1834.

Terebratula compta, Woods. Geol. Obs. in S. Aust., p. 74, wdct., 1862 (non Sow).

Waldheimia imbricata, Woods. Proc. Phil. Soc., Adelaide, fig. 3, 1865; and Trans. Roy. Soc. of N.S.W., p. 79, f. 1, 1878.

Waldheimia macropora, McCoy. Prod. Pal. of Victoria, decade v., pl. 43, figs. 4 and 6, 1877.

W. imbricata, W. Garibaldiana, and W. macropora, Etheridge. Cat. Aust. Fossils, 1878.

W. Garibaldiana is the commonest palliobranch in the middle beds of the River Murray cliffs, and exhibits some slight variation of form and ornament, more particularly in respect to age. The example figured by Etheridge is exceptionally large, and is more angular in outline and more deeply sulcated than the majority of adult specimens which I have seen. In its adolescent stage of growth, which is represented by Sturt's figure, the outline of shell is more or less circular, with slightly convex valves, which are fimbriated; but the front is not depressed, nor is there an appearance of biplication.

The form varies from nearly circular to ovate; and the pentagonal outline, though never obscure in the adult, varies in its angularity, and in the depth of the sulci exhibits much variation, as also the height and number of ribs. The medial depression is occupied with from three to six longitudinal ribs, and the lateral portions of the valves have usually about ten curved ribs on each side.

The loop is that of a *Waldheimia* reaching nearly to the front in a gentle curve, the reflected portion approximating to the long slender erect cruræ, which are rather distant from the hinge plate.

The shell structure is conspicuously punctate as viewed with a pocket lens. The pores are large circular, but not so

numerous as in *W. flavescens* in the proportion of about five to eight.

Dimensions.—A senile example: length, 1·75 inch; breadth, 1·5 inch; depth, 1 inch.

The specimen figured by Mr. Etheridge, another aged form:—Length, 1·5; breadth, 1·25; depth, ·8 inch.

A rather large example, in which the diverging ribs of the peduncular valve and the arched front have not acquired prominence, has length, 1·2, breadth 1·0, depth 0·75 inch.

Alliance.—W. Garibaldiana bears some resemblance to *W. flavescens*, now living off the eastern and southern coasts of Australia; but as pointed out by Mr. Davidson, is less ovate, the beak is less elongated, and it has a smaller foramen; and to which differences has been added by Prof. McCoy that of the very much larger pores of the test of the fossil species. In its adult state *W. flavescens* never acquires that remarkable development of the frontal sinus and longitudinal ridges observable in all aged examples of *W. Garibaldiana*.

Observations.—Mr. R. Etheridge, jun., is evidently wrong in referring Sturt's terebratulid to *Terebratella compta*, as Sturt's figure represents a fimbriated shell, and in other respects is totally unlike *T. compta*. The error is traceable perhaps to Mr. Woods, who reproduced Sturt's figure, and applied to it the name of *T. compta;* a rectification was, however, made by him a few years later, when he described it as a new species under the name of *Waldheimia imbricata*. Though he does not refer to the figure in his "Geological Observations," nor to Sturt's, yet as the drawing which accompanied his paper in the Transactions of the Philosophical Society of Adelaide seems to be a reproduction of one or the other, there cannot be a doubt that Sturt's terebratula and Woods' *Waldheimia imbricata* belong to the one species.

That *W. imbricata*, Woods, is a young example of *W. Garibaldiana*, Etheridge, is an opinion formed after the examination of many score of specimens of the species, ranging from less than one-third inch in diameter to more than one and a half inches in diameter. *W. macropora*, McCoy, is a somewhat intermediate form.

I have selected from a large series collected from the same stratum at Blanchetown three specimens (pl. xi., figs. 1*a*—1*c*), which illustrate as many stages of growth, and to which the names of *W. imbricata*, *W. macropora*, and *W. Garibaldiana* have been respectively applied.

The shell, which Mr. Woods has figured (Trans. Roy. Soc., N.S.W., p. 79, fig. 2) as the young of this species, differs not only in its well-developed longitudinal ribs from juvenile examples of *W. Garibaldiana*, but seems rather to have the

characters belonging to a *Terebratulina*. It bears some resemblance to my *T. triangularis*.

Mr. Etheridge, l. cit., January, 1876, writes:—"When originally described, *W. Garibaldiana* was supposed to have come from the Tertiary beds of Malta; but Mr. Davidson afterwards satisfied himself that it in reality came from Mount Gambier. The nature of the matrix filling the valves bears out this view, for it agrees exactly in lithological character with that adhering to authenticated specimens from the same locality." One would think from this that all doubt as to the *habitat* of the species was set at rest. But not so Mr. Davidson supplies a note to Mr. Woods (Trans. Roy. Soc., N.S.W., p. 78, 1878), to the effect that the Tasmanian shell referred to under the name of *W. imbricata*, nobis, *W. macropora*, McCoy, M.S., "is a new but allied species, and has also a little resemblance to my *W. Garibaldiana*, although I think not the same species." Prof. McCoy says of it, however:—"I do not know how it can be separated from Davidson's *W. Garibaldiana*." Nevertheless, Prof. McCoy remarks in an appendix to his description of *W. macropora*:—"I should have thought Mr. Davidson's *W. Garibaldiana* identical with this species, but in a letter I have seen from him to the Rev. Mr. Tenison Woods—[referred to above]—he thinks differently." I think it not improbable that Prof. McCoy has misinterpreted Mr. Davidson's remarks, which bear solely upon the possible separation of the Tasmanian shell from *W. Garibaldiana*, and do not necessarily imply that the type of the species is not Australian. As Mr. Davidson observes, "the subpentahedral elongated shape—[of the Tasmanian shell]—is remarkable;" but it can be matched with examples from the River Murray cliffs, and is nothing more than one of the forms of this variable species.

The publication of Davidson's name has priority over that of *W. imbricata*, whilst the latter antedates that of *W. micropora* by several years.

Locality and Horizon.—Upper Murravian, near Morgan, and Muddy Creek, Hamilton; rare and of stunted growth. (Tate.)

Middle Murravian, River Murray cliffs, North-west Bend, Blanchetown, &c. (Sturt, Tate, &c.)

Lower Murravian, River Murray cliffs at Mannum; on the River Bremer, three miles south from Callington; rare. (Tate.)

Mount Gambier (Woods); between Mount Eliza and Mount Martha (McCoy); Table Cape, Tasmania (R. M. Johnston.)

Waldheimia furcata, *spec. nov.* Plate vii., figs. 2*a*—2*b*.

Shell obscurely pentagonal, inflated; valves about equally convex, ornamented with sub-acute ribs, which commence from

the umbonal region and increase in number by bifurcation towards the front, and numerous and close-set transverse lamellæ. The line of contact of the two valves is in one plane, and is only slightly indented by ridges and sulci.

Beak produced, sub-erect to slightly incurved, truncated by a small foramen, and separated from the hinge line by a deltidium. Pores of the test circular few and large, as in *W. Garibaldiana*, but not so numerous in the proportion of four to five. Reflected portion of loop unknown; septum very prominent, extending for about half the length of the valve. Cruræ very short; loop towards its origin, rather broadly compressed, and falcately excavated on the upper side.

Dimensions.—Length, ·8 inch; breadth, ·6 inch; depth, ·5 inch.

Observations.—In its sub-pentagonal form and small foramen it closely resembles *W. Garibaldiana*, from which it is separable by its inflated form, straight front margin, and by the bifurcation of its strongly fimbriated ribs, and in certain details of the loop. It comes nearer to *W. flavescens* than *W. Garibaldiana* does, but, as with that shell, it has a much smaller foramen and fewer and larger pores.

Locality and Horizon.—Rather rare in the Polyzoal calciferous sands forming the lower part of the sea-cliffs immediately to the south of Port Willunga jetty, Aldinga Bay, and at Seaford, near mouth of the River Onkaparinga, St. Vincent's Gulf; at Surveyor's Point, Yorke's Peninsula.

Waldheimia (?) divaricata, *spec. nov.*. Plate viii., figs. 8*a*—8*b*.

This species has some resemblance to *W. Garibaldiana*, but is a narrower shell. The brachial valve is less inflated and much depressed in front, and the convexity of this valve is more or less interrupted by a median longitudinal depression, corresponding to which in the other valve is a strong truncated keel. The beak is more depressed, the deltidial area broader, and the beak ridges more conspicuous.

The ribs are *en chevron*, rarely inconspicuous. It also presents in form some agreement with *Magasella Woodsiana*, but in that shell the valves are regularly convex, and the front margin is not angulated.

The loop is unknown, but there is a well-developed septum, which extends for about half the length of the valve. There are no signs of transverse attachments.

Dimensions.—Length, 1 inch; breadth, ·75 inch; depth, ·5 inch.

Locality and Horizon.—In the red raggy limestones of the River Murray cliffs at Mannum (many examples).

Waldheimia Tateana, Woods. Plate vii., figs. 6*a*—6*b*; plate viii., figs. 6*a*—6*c*; plate ix., fig. 2.

Ref.—Terebratula Tateana, Tenison Woods.
Trans. Roy. Soc., N.S.W., p. 79, f. 5, 1878.

Shell longitudinally oval, narrow, widest about the middle; sides slightly rounded, nearly straight in front. Valves moderately convex; surface smooth, marked with a few concentric striæ of growth. Beak long, narrow, sub-erect, truncated by a small circular foramen.

Shell structure conspicuously punctate under a lens; pores oval, large, crowded, rather larger than in *W. Garibaldiana*, but about equal in number.

The loop offers no particular character; in a specimen of a total length of ·8 inch the loop reaches within 1½ lines of the front.

Dimensions of a median-sized example.—Length, ·8; breadth, ·55; thickness, ·35 inch.

Observation.—The species exhibits considerable variation; typical specimens are insensibly connected with an ovate form, with rounded sides and front. Another phase of its variability is exhibited by the development of a biplicated front, which gives to the shell a subpentagonal outline. In this latter variety the peduncular valve has a broad shallow depression in the middle line bounded by obtuse folds, corresponding with which, in the brachial valve, is a broad median ridge, bounded by two short almost marginal sulci. There are imperceptible gradations connecting the oval, ovate, and subpentagonal shapes; the sulcations are always shallow and limited.

The specimens upon which the species was founded prove on actual examination to be immature examples, though they present the leading characteristics of the adults which I have selected as typical of the species.

Locality and Horizon.—Upper Murravian, near Morgan, R. Murray; Muddy Creek, Hamilton (Tate); Table Cape, Tasmania (Woods). Abundant in the glauconitic limestone to the north of Blanche Point, Aldinga (Tate); Muloowortie clays, Yorke's Peninsula (Tepper).

Waldheimia (?) fimbriata, *spec. nov.* Plate viii., figs. 2*a*—2*b*.

Shell longitudinally ovate, sides and front rounded. Valves moderately convex, the peduncular much the deeper. Surface marked by rounded radial ribs, which extend to about one-third; about five ribs occupy the front, and a like number on each side; the rest of the surface is smooth, with a few concentric striæ of growth. Shell structure conspicuously punctate under a lens.

Beak largish, suberect, and truncated by a large foramen.

Loop unknown.

This species has much affinity with *W. Tateana*, particularly with the biplicated variety of it, but the more pronounced costations and the larger foramen separate it.

Dimensions.—Length, ·9 inch; breadth, ·7 inch; depth, ·55 inch.

Locality and Horizon.—Glauconitic limestones, Blanche Point, Aldinga Bay (a few examples).

Waldheimia (?) Johnstoniana, *spec. nov.* Plate viii., figs. 9*a*—9*b*.

Shell elongate, oval, subpentagonal; much longer than wide, with nearly parallel sides, attenuating somewhat rapidly to the beak, but truncated in front. Front margin binsinuate, the sulci shallow and very short, flanked on each side by faint plicæ.

Valves about equally and regularly convex, not inflated. Surface smooth, with a few inequidistant concentric lines of growth. Test minutely and densely punctate, visible under a pocket lens.

Beak short and stout, erect, transversely truncated by a rather large circular foramen; deltidial pieces small, fused together; beak ridges inconspicuous.

Loop unknown, but the brachial valve shows a strongly impressed medial line.

Dimensions.—Length, 1·2; breath, ·7; thickness, ·6 inch.

Observations.—It is allied to *W. Tateana*, through the biplicated variety of that species, but is relatively longer and narrower, and its foramen is much larger, and the beak shorter and stouter.

Locality and Horizon.—Glauconitic limestone, north side of Blanche Point, Aldinga Bay (nine examples).

The species is named after Mr. R. M. Johnston, F.L.S., to whom Australian geologists are indebted for much of their knowledge on the Miocene fauna and geology of Table Cape, Tasmania.

Waldheimia (?) insolita, *spec. nov.* Plate ix., figs. 6*a*—6*b*.

Shell oval, nearly as long as wide; sides and front margins curved; valves moderately convex; surface smooth, with a few concentric lines of growth.

Beak small, erect, depressed, with strong beak ridges, obliquely truncated by a rather small circular foramen. Deltidial pieces well-developed.

Loop that of *Waldheimia*, septum about one-third the length of the brachial valve. Punctations of test visible under a pocket lens.

Specimens collected from a marly band in Blanche Point Cliff, Aldinga, exhibit radial flashes of colour.

Dimensions.—Length, 1·1; breadth, ·9; thickness, ·45 inch.

Observations.—This species has some external resemblance to *Terebratula Aldingæ*, but differs in its rounded outline, in the shape of its beak, and in its smaller foramen. It varies in the degree of convexity of the valves, the more depressed forms recalling the inflated variety of the Liassic *W. numismalis*, but without its circular shape and minute foramen. It also bears a striking likeness to *Terebratula Hilarionis*, Meneghini, from the Eocene of Italy (*vide* Geol. Mag., 1870, p. 401, t. 17, f. 4, 5).

Locality and Horizon.—Glauconitic limestones, Aldinga Bay; upper part of chalk rock, Bunda Cliffs, Great Australian Bight (R. T.); Upper Eocene, New Zealand, the identification based on specimens kindly forwarded by Dr. Hector.

Waldheimia grandis, T. Woods. Pl. xi., figs. 3 and 4.

Ref.—Trans. Adelaide Phil. Soc., 1865, t. 2, fig. 1.

Syn.—W. Gambierensis, Etheridge, jun., Annals and Mag. Nat. Hist., vol. 17, p. 19, t. 2, fig. 4 (1876).

"Shell smooth, very thick, elongated, convex; ventral valve subcarinated, margin with two obscure plaits in the older specimens; beak short, obtuse, obliquely truncated, with a large circular cup-shaped thickened foramen. Loop two-thirds as long as the dorsal valve; lamellæ slender, straight, reflection unknown; septum, as long as loop, gradually tapering; cruræ thick, semicircular. Length 2·2 inches, breadth 1·4 inches. It is a very variable shell."—T. Woods.

Etheridge's figure represents the adult form of the species, though its dimensions are below the average of fully developed examples. The Rev. J. E. Tenison Woods' illustrations of this species are of a large but somewhat immature specimen, in which the biplicated front, characteristically shown in Mr. Etheridge's drawings, is only commencing to be formed. There cannot be a doubt of the relationship existing between the two shells; they, moreover, came from the same locality.

Etheridge referred his species to *Waldheimia*, solely because a mesial septum was indicated by an impressed line on the brachial valve. Tenison Woods, however, proceeds with more caution, and states that he is not certain if it be probably referred to that genus, though the unreflected portion of the loop was alone unknown to him. Having been fortunate in obtaining a full display of the interior, uncertainty as to the generic position of the species is entirely removed. The loop presents no character worthy of note.

Mr. T. Davidson says:—"It approaches to the Italian

Tertiary *T. Pedemontana*, but still distinct, being more regularly oval."

My notes referring to *W. Tateana* and reproduced by Mr. Woods, Trans. Roy. Soc., N.S.W., have been by mistake transferred by him to *W. Gambierensis*.

Dimensions of a large example:—Length, 2·4; breadth, 1·5; thickness, 1·3 inches.

Locality and Horizon.—Very abundant in the calciferous sands occupying the middle portion of the River Murray cliffs about Blanchetown and Morgan; rare in the red yellow calciferous sandstone forming the upper part of the Mannum cliffs on the River Murray; River Bremer, four miles south from Callington (Tate). Rather rare in the coralline limestone of Mount Gambier (Woods). Table Cape, Tasmania (R. M. Johnston).

Waldheimia (?) Crouchii, T. Woods. Plate xi., fig. 8.

Ref.—Trans. Phil. Soc., Adelaide, 1865, t. 2, fig. 2.

This species is founded on a brachial valve of nearly circular outline, and with seven large angular plaits on the anterior margin.

Dimensions.—Length, 2·3 inches; breadth, 2·2 inches.

Locality.—Mount Gambier (Woods).

Observations.—This appears to be very distinct from its congeners, but I suspect it to be closely related to *W. grandis*.

Waldheimia MacLeani, *spec. nov.* Plate vii., figs. 1*a*—1*c*.

Shell large, a little longer than wide, with a sub-pentagonal outline, convex; greatest width about the anterior third of the whole length, rapidly attenuating posteriorily and gradually narrowing anteriorily to the truncated front margin. Lateral margins narrowly plicate, front margin sinuous. *Brachial* valve regularly convex and deep, ornamented by a few curved costæ, which are limited to near the margin, with an ill-defined medial longitudinal fold bounded by two short depressions. *Peduncular* valve convex deep, the marginal plications more pronounced and longer than in the brachial valve; a shallow depression extends from about the middle of the front, where it is bounded by two rounded plaits each equal in width to the depression. *Beak* moderately produced, sub-erect, truncated by a large circular foramen. *Surface* of both valves with concentric lines of growth.

Young shell ovate, without plicæ, the line of junction of the valves is in one plane.

Dimensions in inches:—

	Length.	Width.	Depth.
(1.)	1·175	1·3	·45
(2.)	1·9	1·4	·5

Observations.—The general shape of *W. MacLeani* is that of *W. Garibaldiana*, but its outline is not so angular, it is more convex, the plications shorter and stouter, and it wants the angular folds of the peduncular valve and the depressed angular front; the foramen is, moreover, very much larger, and the beak more voluminous. Young shells of these two species are very distinct from one another.

The alliance of *W. MacLeani* is rather with *W. grandis*, though strikingly different in shape. Young shells of these species at the same stage of growth show the following distinctive characters :—

W. MacLeani.	W. grandis.
Rounded front	Narrowed front
no fold	mesial folds
margin in one plane	margin flexuous
larger foramen.	smaller foramen.

The species is named after my friend D. MacLean, Esq., J.P., who has rendered great service in the cause of South Australian palæontology, particularly by the bringing to light under great difficulties the cranium of a balænoid whale imbedded in the River Murray Cliffs at Murbko, fifteen miles north of Blanchetown.

Locality and Horizon.—*W. MacLeani* is profusely abundant in a chalky limestone, which commences the limestone and shell beds forming the Upper Murravian series at Blanchetown and northward for about 18 miles. Many of the fossils in this stratum, at a point about three-quarters of a mile south from Mr. MacLean's residence, Glenforslan, are pseudomorphs after selenite, but in the case of the Waldheimias their tests are of the original substance, though their interiors are for the most filled with gypsum. By breaking the shell away there may be obtained most beautiful casts enclosing the loop, the opacity of which makes it a well-defined object as seen through the transparent gypsum.

Waldheimia Vincentiana, *spec. nov.* Plate x., figs. 1 and 8.

Shell elongated, oval, much longer than wide, greatest breadth in the middle, whence the shell tapers gradually towards the front and beak; marked with inequidistant concentric lines of growth. Test thick, densely punctated.

Valves nearly equally convex; the brachial valve most convex in the umbonal region. Lateral margin of the valves nearly straight, front margin slightly bisinuated.

Beak short, prolonged, and transversely truncated by a circular foramen of large dimensions. Deltidial pieces distinct, rather small and narrow, beaks moderately well defined.

An impressed line on the surface of the brachial valve, extending for about one-third its length, indicates the existence of a mesial septum. Interior unknown.

A small shell, bearing an external resemblance rather to *W. Vincentiana* than to any other known species, possesses internal characters totally different from those of any Waldheimia. The septum is remarkably long, extending through a distance of ·65 inch of a total curvilinear length of the brachial valve of ·85. The loop is broadly compressed, the forward limb is conduplicate, and is excessively expanded anteriorly and confluent with the returning portion of the loop; at this point the depth is $\frac{1}{5}$th of an inch.

Dimensions.—Length, $2\frac{3}{4}$ inches; breath, $1\frac{7}{10}$ inch; depth, $1\frac{3}{10}$ inch.

Observation.—The only species from the Australian Tertiaries that bears any resemblance to *W. Vincentiana* is *W. gigas* (T. Woods), which has, however, a more elongated shape, and is more attenuated and conspicuously biplicated at the front.

Locality and Horizon.—In the raggy limestones about one mile south from Port Vincent (or Surveyor's Point), west coast of St. Vincent's Gulf (two examples).

Waldheimia Taylori, Etheridge. Plate xi., fig. 2.

Ref.—Annals and Mag. of Nat. Hist., vol. xvii., p. 18, t. 1, f. 3 1876.

"Shell elongato-ovate, longer than wide; greatest width near the middle. Peduncular valve exceedingly convex, with two slightly diverging obtusely-rounded ridges proceeding from the beak towards the front, where they become lost, and enclosing between them a narrow space which in its upper part is rounded, and becomes flattened or a little concave towards the front of the shell; the lateral portions of the valve are also flattened, but not concave; beak produced, incurved, and truncated by an oblique circular foramen contiguous to the umbo of the brachial valve, but separated from it by a small deltidium. Brachial valve, slightly convex in the umbonal region, becoming almost flat towards the front, but presenting in its longitudinal outline a gentle continuous convexity. Lateral margins a little flexuous; surface marked by a few concentric lines of growth; shell distinctly punctate.

Length, 2 inches $3\frac{1}{2}$ lines; width, 1 inch 10 lines; depth, 1 inch 5 lines.

Locality and Horizon.—Coralline limestone of the Murray River cliffs, near the Great Bend, S. Aust. *Mus. Prac. Geology*, London." Etheridge.

This shell is unknown to me, unless I have mistaken for it a narrow form of *W. Corioensis*, which occurs at Mannum. It

is, however, distinguishable from the Mannum fossil by its broad front and the tripartite division of the peduncular valve. *W. Taylori*, *W. Corioensis*, and *W. sufflata*, which are of about equal size, are among the largest species of the genus.

Waldheimia Corioensis, McCoy. Plate ix., figs 4 and 7; plate x., fig. 4.

Ref.—Palæontology of Victoria, Decade v., tab. 43, figs. 1—3, 1877.

Shell sub-ovate, greatest width about the middle, margin of sides convex in the middle. Pedunculated valve very convex or very obtusely carinated along the middle, sides flattened, very slightly convex, becoming slightly concave near the lateral margins; in profile it is much arched near the large incurved beak, becoming tangentially straight towards the front, which is elevated at the margin into a deep sinus (bisinuate when old). Brachial valve flattened in the umbonal half, with lateral margins abruptly deflected at right angles towards the other valve, becoming gradually depressed in the middle towards the narrowed front; in old specimens the mesial depression is divided by a wide slight convexity.

Foramen moderate, deltidium tripartite, the narrow middle portion convex; beak ridges moderate, angulated.

Surface smooth, with moderate lines of growth. Mesial septum about one-half the length of the shell. Length, $2\frac{2}{3}$ inches. (Abridged from the original diagnosis.)

A few large terebratulids obtained at Mannum seem to agree generally with the example of *W. Corioensis*, represented by the woodcut on p. 11. The least imperfect of them is shown by fig. 4, pl. x.

A fragment of the umbonal half of a large brachial valve shows some peculiarities of the rostral boss. The hinge plate is broad and deeply concave, the cardinal process is deeply tripartite, the central lobe erect, thick, and compressed, the laterals are divaricate, lamellar, and confluent with the cruræ. (Pl. ix., fig. 7.)

A single specimen of another large terebratulid (fig. 4, pl. ix.), though differing greatly in its wide and deep mesial depression, is provisionally referred to this species.

Locality and Horizon.—Lower Murravian, rare in raggy limestones at Mannum (Tate).

Miocene Tertiary, Corio Bay, Geelong; Jan Juc (abundant), more rare at Muddy Creek (McCoy).

Dimensions of the specimen, fig. 4, pl. x:—Length, 2·65 inches; breadth, 1·8 inch; thickness, 1·6 inch. Of the variety, fig. 4, p. ix):—Length, 2·2; breadth, 2; thickness, 1·2 inches.

Waldheimia pectoralis, *spec. nov.* Pl. vii., figs. 1*a*—*d*.

Shell elongate to elongate-ovate, longer than wide; greatest width near the middle; valves very unequal, lateral margins strongly curved, deflected. Brachial valve strongly convex longitudinally; at the anterior third flattened; with a shallow sulcus proceeding from the beak and widening out to the front margin, which is sinuated or slightly plicate. Peduncular valve very convex and deep, with a flattish triangular area corresponding with the sulcus of the other valve.

Loop reaching to near the front margin; lamellæ slender, with a slight curve towards the central line; reflected portion opening out to three times the width of the other; septum high, extending for three-sevenths of the length of the brachial valve.

Beak produced sub-erect, truncated by a very small foramen, and separated by a large crescentric deltidium of one piece, which is corrugated transversely to its length. Surface of the shell with concentric lamellæ of growth; densely and minutely punctated. Immature shell with a shallow sulcus extending to the front margin, which is depressed and sinuous.

Dimensions—Length, 2·25 inches; breadth, 1·8; thickness, 1·1 inch.

Locality and Horizon.—Not uncommon in the glauconitic limestone, which forms the base of Blanche Point Cliff, Aldinga.

Waldheimia (?) sufflata, *spec. nov.* Plate vii., fig. 3; plate viii., fig. 4.

Shell subovate, greatest width about the middle; lateral margins convex in the middle, becoming straight or slightly bisinuated (rarely biplicate) towards the narrow rounded front. Test thick, surface smooth, with numerous moderately strong lines of growth. Shell structure minutely and closely punctate, as viewed under a lens. Peduncular valve very convex in a longitudinal direction, and regularly convex transversely. Beak strongly incurved, slender, foramen minute. Deltidium of one piece, broadly triangular and deeply concave. Brachial valve very convex, faintly impressed or flattened medially, becoming gradually depressed in the middle towards the somewhat narrowed front.

Septum a little less than half the length of the valve. Loop unknown.

Dimensions.—Length of a large specimen, 2·65 inches; width, 1·8; depth, 1·6.

Observations.—This species has the minute foramen and slender beak of *W. pectoralis*, but in other respects the differences are very great. Some examples partake of the shape of certain varieties of *W. Corioensis*, but despite this

general resemblance, *W. sufflata* is at once known by its incurved, minutely perforated beak.

Locality and Horizon.—Rare in the yellow Polyzoal calciferous sands, forming the base of the sea cliffs, south side of Willunga Jetty, Aldinga Bay; and rough shelly limestones at Surveyor's Point and Stansbury, Yorke's Peninsula. Many examples.

Terebratulina Scoulari, *spec. nov.* Plate viii., figs. 3*a*—3*d*.

Shell pentagonal, about half as long again as wide, broadest about the middle, tapering gradually towards the truncated front; sides and front slightly curved. Peduncular valve uniformly convex, with a slight median depression in the anterior half of the valve. Brachial valve moderately convex. Surface ornamented with very numerous radiating rounded ribs, which are repeatedly bifurcated; the interspaces rather narrower than the breadth of the ribs; the entire surface crossed by close-set concentric lines of growth; the ribs about the margins of the umbonal regions with imbricating scales.

Hinge line narrow, arched; beak moderate; foramen, in the adult, complete, circular, moderate, laterally margined by small deltidial plates.

Loop that of *Terebratulina*.

Dimensions.—Length, 1·2 inch; breadth, ·75; thickness, ·5.

Observations.—*T. Scoulari* belongs to the group typified by *T. caput-serpentis*, from which it differs in being more depressed and attenuated towards the front, and in having the ribs and concentric lines more numerous and finer; the form of the loop is also different. In shape it closely agrees with *T. Japonica*, as also to the recent Australian species *T. cancellata*. From the latter it differs in its more pentagonal outline, less inflated valves, and coarser ribbing; characters which are very pronounced in the young. The annulus of the loop of *T. Scoulari* is rather subcircular; it is smaller and more contracted than that of either of the above.

The specific name is in compliment to Mr. Gavin Scoular, who has so ably worked out the geology of Munno Para.

Locality and Habitat.—Rare in the Upper Murravian, near Morgan, and at Muddy Creek, Victoria (*Tate*). Common in the Middle Murravian white calciferous sand rock. Not uncommon in the glauconitic limestones of Aldinga Bay (*Tate*). Rare in the Muloowurtie clays, Yorke's Peninsula (*Tepper*).

Terebratulina Davidsoni, Etheridge. Pl. xi., figs. 6*a*—6*d*.

Ref.—T. (?) Davidsoni, Annals and Mag. of Nat. Hist., 1876, t. 1, f. 1, p. 16.

"Shell small, oval, flattened, tapering towards the beak, rounded towards the front; lateral margins in one plane, not

sinuous. Peduncular valve slightly convex, with the beak but little produced, truncated by a slightly oblique foramen more or less below the apex of the beak, excavated out of its substance, and completed by the two small deltidial plates and the umbo of the brachial valve. Brachial valve almost flat, with the slightest indication of a mesial sinus in the front; hinge-line a little arched. Surface of both valves ornamented with a large number of fine radiating ribs, occasionally bifurcating, and a few concentric lines of growth; margins crenulate."—*Etheridge.*

The founder of this species, being unacquainted with its internal portions, placed it with a doubt in the genus *Terebratulina*, but having seen the loop, which offers no special character, I can confidently refer it to that genus.

The shell is conspicuous from its almost hemispherical shape; the peduncular valve being strongly convex and the brachial valve flat, or with a slight medial depression. The ribs, which are usually somewhat thick and crowded, are crenulated and nodulated towards the front by strong lines of growth. The edge of the valves is conspicuously crenulate.

Dimensions of a large and narrow specimen—Length, ·46 width, ·35. One of the ordinary size gives—Length, ·35; width ·3; depth, ·28 inch.

Locality and Horizon.—This is one of the most widely diffused of our palliobranchs, though not generally abundant. More commonly the valves are widely gaping.

In the Upper Murravian beds near Morgan on the River Murray and cotemporaneous beds of Muddy Creek, near Hamilton, Victoria (Tate).

In the Lower Murravian at Mannum (Tate), and in the coralline limestone at Mount Gambier (Woods and Tate).

In the glauconitic limestones, Aldinga Bay, and corresponding beds at Surveyor's Point and Stansbury, Yorke's Peninsula (Tate).

Terebratulina lenticularis, *spec. nov.* Plate vii., figs. 4*a*—*c*.

Shell small, broadly oval, a very little longer than wide. Brachial valve regularly convex deeper than the peduncular valve, which is moderately convex and slightly impressed in the middle line towards the front. Surface ornamented with numerous rounded, bifurcating radial ribs, crowded towards the front, and with imbricating concentric lines of growth towards the same region. Beak stout, obtuse; hinge line narrow, slightly arched; fissure large, deltidial pieces inconspicuous.

Dimensions.—Length, ·35; breadth, ·3; depth, ·15 of an inch.

Observations.—This species is with some difficulty to be distinguished from *T. Seebachi*, Schloenbach, from the Upper Chalk of Hanover and Oligocene of Saxony, as it resembles it in shape and ornamentation. *T. lenticularis* differs, however, in its arched hinge line, smaller and obtuse beak, and in the limited development of the deltidium.

Locality and Horizon.—Abundant in the glauconitic limestones, north of Blanche Point, Aldinga Cliffs (Tate), and in the yellow clays at Muloowurtie, Yorke's Peninsula (Tepper).

Terebratulina triangularis, *spec. nov.* Plate viii., figs. 7*a*—7*d*.

Shell triangularly ovate, a little longer than wide; widest at about the anterior—third; front and sides rounded. Surface ornamented with acute ribs, bifurcating; interspaces linear, fimbriated by imbricating lines of growth. Brachial valve flattish, slightly convex in the posterior part, with a faint median depression towards the anterior, which produces a faintly sinuous front margin. Peduncular valve regularly convex. Beak prominent, acute; hinge line narrow and straight; foramen longitudinal, large, and triangular.

Dimensions.—Length, ·35 inch; breadth, ·3 inch; depth, ·15 inch.

Locality and Horizon.—In the marls at Blanche Point, Aldinga Cliffs, and in the chalky limestone, Bunda Cliffs, Great Australian Bight.

Terebratella Tepperi, *spec. nov.* Plate ix., figs. 8*a*—8*c*.

Rounded, moderately inflated, smooth, with concentric lines of growth. Front margin plane.

Brachial valve regularly and moderately convex to nearly flat. Peduncular valve inflated and medially subangulated. Beak broad, blunt, foramen large, deltidia small, separate.

Loop imperfectly known; but so much as remains in the sole specimen which has been found to afford internal characters is clearly that of *Terebratella*. The medial septum is remarkably short, being less than one-third the length of the valve.

This species belongs to the group typified by the recent New Zealand *T. rubicunda*, Solander, for which it cannot be mistaken.

Dimensions.—Length, ·85; breadth, ·8; thickness, ·45 of an inch.

Locality and Horizon.—"Muloowurtie Clays," near Ardrossan, Yorke's Peninsula (five examples). Collected by Mr. Tepper, to whom the species is dedicated. For an account of the geology of the Muloowurtie Cliffs see his paper Trans. of this Society, vol. ii., p. 74.

Terebratella (?) pentagonalis, *spec. nov.* Plate ix., figs. *5a—5b.*

Shell small, obtusely pentagonal, longer than wide, broadest about the middle. Valves moderately convex, flattened along the middle; surface marked with imbricating lamellæ concentric with the lines of growth.

Beak large, rather produced, obtuse; foramen large, oblong, incomplete; deltidial pieces small. Interior unknown, but the shell is placed in the genus *Terebratella*, because of its incomplete foramen, and general resemblance to *T. rubicunda* and its allies.

Dimensions.—Length, ·65; breadth, ·5; thickness, ·35 of an inch.

Locality and Horizon.—Glauconitic limestone, north side of Blanche Point, Aldinga Bay. Two examples.

Terebratella furculifera, *spec. nov.* Plate xi., figs. *7a—7c.*

Shell orbicular-oval, a little longer than wide; side and front margins in one plane. Valves moderately convex, the peduncular valve a little the deeper, obtusely carinated in the rostral half. Surface smooth, with a few concentric lines of growth; conspicuously punctate under a lens.

Beak small, erect, depressed with strong ridges; truncated by a small triangular foramen; deltidial pieces rather large, disunited.

Septum less than half the length of the valve. Loop doubly attached, first to the diverging portions by transverse processes from the end of the septum, and secondly by a forked process which unites the abruptly truncated terminal bend of the loop to the summit of the extremity of the septum. I have no less than five specimens showing this peculiar conformation of the oop.

Dimensions.—Length, ·65; breadth, ·55; depth, ·3 of an inch.

Observations.—Externally the species resembles *Terebratula Aldingæ* and *Waldheimia insolita*, but may be recognised by the form of its incomplete foramen.

Locality and Horizon.—In the glauconitic limestones, Blanche, Point, Aldinga Bay. Six examples.

Terebratella (?) Woodsii, *spec. nov.* Pl. ix., figs. *10a—10c.*

Ref.—Waldheimia Corioensis, Trans. Royal Society, N.S.W.; p. 79, fig. *3a—3c*, 1878.

The Rev. Mr. Woods referred a small shell with a deep depression on the smaller valve from Table Cape to *W. Corioensis*, McCoy. But until young shells of that species are known, it would be well to regard the identification as bad. The only palliobranch from our Tertiaries, which possess a mesial depression and somewhat similar shape to it is the young

shell of *Magasella compta*, but the beak and foramen of the latter are very small. The excellent figures of the species, drawn by Mr. R. M. Johnston, which I have had reproduced, show a large incomplete foramen, and may therefore indicate a young *Terebratula* or allied form. If the shell be an adult, then it probably belongs to *Terebratella*, where I have ventured to place it.

Locality and Horizon.—Miocene strata, Table Cape, Tasmania (Johnston).

GENUS MAGASELLA, Dall.

The four following species are referred to *Magasella*, because of the strong resemblance they bear to *Terebratella* (*?*) *Cumingiana*, now transferred by Mr. Davidson to Dall's genus, whose description has not yet reached me. They agree externally in having a prominent beak with a small foramen and the deltidium blended with the shell; the loop presents the characters of *Terebratella*, whilst in others it seems to be related to that of *Magas*.

Magasella compta, Sowerby. Pl. x., figs. 6*a*—6*e*.

Ref.—Terebretella compta, Sow., in Strezlecki's Phy. Desc. of N.S.W., &c., 1845, p. 297, t. 19, f. 4 (*Non* Woods' Geol. Obs. S. Aust., p. 74, 1862).

Terebratella compta, Woods, Trans. Phil. Soc., Adelaide, f. 4*a*—*b* (*? non* 4*c*—*e*), 1865. (*Non* Etheridge, jun., Ann. and Mag. Nat. Hist. t. 2, f. 5, p. 19, 1876.)

"Shell smooth, thin trapeziform; lateral margins sub-incurved, anterior margin small obtuse. Hinge area large, with a longitudinal depressed line at either side. Brachial valve triangular, rounded slightly, truncated in front with a small median sinus; peduncular valve faintly keeled. Foramen terminal, small, and round."—Sowerby. To which description Mr. Woods has added brachial valve sub-cordiform, flat, and both valves marked with concentric lines of growth.

The young is nearly circular in outline, with a marginal median sinus in the brachial valve; beak and foramen small, with little or no deltidial area.

The loop is only known by one example (fig. 6*e*); compared with that of *M. Cumingiana*, the following differences are observable:—In *M. Cumingiana* the erect and thick projection of the septum has, in reality, two distinct slender loops attached to it. But in the example before us the loop at its reflection is broadly expanded, and embraces the elevated part of the septum; it then extends into an almost complete circle. It thus has considerable analogy with that of *Magas* (*sensu strictu*). The different dispositions of the loop in *M.*

Cumingiana and *M. compta* arise from the relative massiveness of the septum and loop; in the former the slender loop is lost in the excessively stout septum along which it may be considered to be decurrent, till it becomes again free, and forms the second annulus; whereas in *M. compta* the septum is lost as it were in the much greater mass of the broad lamellæ of the loop, and the loop seems to be only once attached to the septum.

Dimensions of a larger specimen :—Length, ·9; breadth, ·7; depth, ·5 of an inch.

Observations.—M. compta being the oldest described among the related forms need not here be compared with them; its salient characters may, however, be pointed out. Trapeziform, contracted, depressed and biangulated in front; hinge line straight, very broad; beak suberect; deltidial area very large. The species has hitherto been almost unknown except by Sowerby's figures and descriptions, as the common shell which is commonly referred to it, is a distinct though allied species. Figs. 4*a* and 4*b* of Mr. Woods' paper, *op. cit.*, doubtlessly represent Sowerby's shell; but his fig. 4*c* agrees well with *M. Woodsiana*, mihi, and I strongly suspect that the interiors shown by figs. 4*d* and 4*e* belong to the same. A comparison of the original figures of *T. compta*, and those of *T. compta*, Etheridge, *op. cit.*, cannot fail to convince one that two species are represented by them.

Locality and Horizon.—Not rare in the Lower Murravian beds at Mannum on the R. Murray, and near Callington, on the R. Bremer. Rare at Stansbury, Surveyor's Point (*Tate*), at Muloowurtie, Yorke's Peninsula (*Tepper*); Mount Gambier, South Australia, and Portland, Victoria (*Woods*).

The types were obtained "from a raised beach at Point Fairy," on the Cape Otway coast, Victoria; but as in other instances, Strezlecki mistook our Older Tertiary deposits for Post Tertiary beaches.

Magasella Woodsiana, *spec. nov.* Plate x., figs. 3*a*—3*d*.

Syn.—Terebratella compta (pars), Woods, loc. cit., fig. 4*c*—4*e* (1865).

id., Etheridge, loc. cit., 1876.

Shell pyriformly ovate, longer than wide, margins flexuous. Valves unequally convex, peduncular valve much the deeper, which is longitudinally and obtusely carinate. Brachial valve regularly convex in the umbonal half, medial depressed towards the front.

Beak broad and stout, slightly incurved and truncated by a nearly transverse circular foramen of moderate dimensions. Hinge line much arched, beak ridges sharply defined, enclosing

a large triangular area, somewhat concave except where interrupted by a broad medial longitudinal ridge.

Surface with concentric striæ and a few ridges of growth; test thin, conspicuously punctate.

A portion of the loop has been illustrated by Mr Etheridge, and very little more of the interior of the adult shell than is there shown is known to me, though a great number of specimens have been sacrificed.

In the adult the medial septum is continued to near the front of the valve, and at about half its length it gives off on each side a flatly expanded process by which it is connected with the diverging portions of the loop. The septum does not appear to have been elevated, as in *M. Cumingiana*. If the specimen to which the following description refers belongs to *M. Woodsiana*, then little remains to complete our knowledge of the interior of the species. Mr. Woods writes:—"Septum round and solid, lamellæ of loop widening to the point of attachment, becoming again contracted at the reflection, and then extending into an almost complete circle with a slight projection towards the hinge."

In young specimens the septum assumes different forms, as I have proved by the examination of more than a dozen specimens from the River Murray cliffs and Muddy Creek. In one from near Morgan the septum is actually adherent to the opposite valve, and the loop shows the same disposition as in *M. compta* (pl. x., fig. 6*e*). Between this form of septum and that of the adult every possible gradation is exhibited.

Dimensions.—Length, ·75; breadth, ·55; depth, ·4 of an inch.

Observations. — *Magasella Woodsiana* bears a considerable external resembance to the recent *M. Cumingiana*, but differs in its less trapezoidal shape, and in the greater breadth and height of the deltidial area. Internally the characters are widely different in detail, and the thick mesial ridge in the interior of the peduncular valve of *M. Cumingiana* is peculiar to that shell. The Port Jackson specimens of *Magasella* presented by the Rev. Mr. Woods, who directed my attention to the similarity between it and the Mount Gambier fossil, seems to me to agree better with Reeve's *Bouchardia fibula* than with *Terebratella Cumingiana*, but which Mr. T. Davidson believes to be only a varietal form of the latter.

Locality and Horizon.—Upper Murravian, near Morgan, and at Muddy Creek (Tate); Lower Murravian, at Morrundi, on the River Murray, near Blanchetown; Mannum; and near Callington (Tate). Mount Gambier (Woods & Tate). Yellow calciferous sands, Aldinga Bay; and at Stansbury (Tate).

Magasella Tenisoni, Woods. Plate xi., fig. 5*a*—5*c*.

Reference.—Terebratella Tenisoni, Trans. Phil. Soc., Adelaide, 1865, t. ii., figs. 5*a*, 5*b*, and 6.

"Shell elongated, usually convex. Peduncular valve, trapeziform, keeled deeply, and terminating in a notch at the anterior margin. Brachial valve orbicular and tapering to a point which fits into the notch on the other valve. Beak obtuse, deltidium striated, foramen oblong.

"Septum thickened, curved, and produced so as to touch the opposite valve; attachments of the loops at the centre, and nearer to the shell than to the edge of the septum. Muscular impressions deep. Hinge and crura sloping away from the septum, with a deep sinus in the centre.

"*Size*, variable, but adult specimens 0·7, breadth 0·4 of an inch.

"This curious species has strong points of resemblance to *T. Evansii*, but whose individual characters are very distinct. In both the septum is produced so as to touch the opposite valve."—Woods.

Locality.—Mount Gambier and Portland (Woods).

Magasella deformis, *spec. nov.* Plate x., figs. 5*a*—5*c*.

Shell oblong-ovate, margins of sides convex in the middle. Peduncular valve very convex, obtusely carinated along the middle, sides convex becoming flat or slightly concave near the lateral margins. Brachial valve regularly convex in the umbonal half, with lateral margins abruptly reflected, becoming abruptly and considerably depressed towards the narrowed front.

Beak depressed, truncated by a minute foramen; deltidial area broad and concave; beak ridges well defined.

Surface with a few lines of growth; malleated punctate under a lens.

Mesial septum thick, about half the length of the valve, abruptly produced so as to touch the opposite valve; diverging lamellæ of loop nearly parallel, connected by short transverse processes to the point of origin of the septal projection; thence continued beyond for about half as far again, widening at the inflection, and apparently becoming attached near the apex of the septal projection.

Dimensions.—Length, ·45; breadth, ·3; depth, ·27 of an inch.

Observations.—The reflection of the lateral margins of the valves is a character belonging to the adult shell. In its young state it resembles *M. compta*, and somewhat *M. Woodsiana* at the same stage of growth, but is at once distinguished by its beak and its malleated test.

Locality and Horizon.—In the glauconitic limestones Blanche Point, Aldinga Bay. Nine examples.

Thecidium australe, *spec. nov.* Plate ix., figs. 3*a*—3*c*.

Shell minute, one-eighth of an inch in diameter, triangular-ovate, inequilateral, attached by the umbonal surface of the peduncular valve. Surface smooth, conspicuously punctate, and ornamented by a few thick folds of growth.

Brachial valve flattish; hinge line straight, but interrupted in the middle by a small subquadrate cardinal process; interior unknown.

Peduncular valve, inflated and produced at the umbo, which is obliquely truncated by the surface of attachment; interior with coarse radial striæ, which crenulate the thin margin. Hinge teeth prominent. Within the umbonal cavity is a cup-shaped cavity for the attachment of the adductor muscles, divided longitudinally by a septum, which is continued half as far again beyond it.

This notice is, I believe, the first record of the occurrence of the genus, either recent or fossil in the southern hemisphere.

Locality and Horizon.—In the Miocene strata at Muddy Creek, from which I obtained one perfect shell and four peduncular valves.

Rhynchonella squamosa, Hutton. Pl. ix., figs. 9*a*—9*b*.

Ref.—Cat. Tertiary Mollusca of New Zealand, p. 37, 1873.

Syn.—Rhynchonella cœlata (McCoy, MS.), Woods, Trans. Roy. Soc., N.S.W., p. 77, 1878.

Rhynchonella lucida, McCoy, M.S. (*non* Gould, 1860).

"Shell irregular, more or less orbicular; valves inequal, the ventral flatter with a deep groove; dorsal valve very convex; both with fine radiating scaly striæ. Length, ·7; breadth, ·75; height, ·5. Easily distinguished from *R. nigricans* by its more numerous striæ."—Hutton.

Remarks.—The task of establishing a correct synonym of manuscript names is one that is very properly unattempted by monographers; but in this instance the manuscript names of McCoy have a fictitious value from the fact that they have been published with such remarks as may lead up to their identification. The Rhynchonella found at Table Cape, Tasmania, was pronounced by Tenison Woods (Trans. Roy. Soc. Tasm., p. 15, 1874) to be identical with *R. lucida* of McCoy, common in the Geelong Miocene beds; subsequently we find the same author (Trans. Roy. Soc., N.S.W., 1878) referring to it as *R. cœlata*, McCoy. Doubtless the two names have been given to the same shell; and it is probable that the change of denomination was

necessitated by the knowledge of the prior occupation of the cognomen *lucida* by a recent shell described by Gould in 1860.*

The identity of *R. cælata* with *R. squamosa*, Hutton, rests upon the characters given to it by Mr. Woods, and upon the observations of Mr. Davidson published therewith (op. cit. p. 77).

"Rounded trigonal, with a strong mesial fold, with many fine imbricating ribs."—T. Woods.

"A most beautiful species, very closely related to *R. nigricans*, from New Zealand. Some examples in external shape cannot be distinguished, but I have not observed on any recent *R. nigricans* such prominent and strongly marked imbricated striæ. The fold and sinus seem more strongly marked on the fossil form. The ribs also seem smaller or more delicate than on real *nigricans*."—T. Davidson.

It will be observed that Mr. Davidson uses the same characters to distinguish the fossil from the recent *R. nigricans* as Prof. Hutton had previously employed in founding the species *R. squamosa*.

Locality and Horizon.—In the glauconitic limestone, north of Blanche Point, Aldinga Cliffs (*Tate*) ; yellow clays of Muloowurtie (*Tepper*), and at Stansbury (*Tate*), Yorke's Peninsula ; on the R. Bremer, at Salem, near Callington (*Tate*).

Muddy Creek, Hamilton (*Tate*), and from several Miocene beds in Victoria (*McCoy*) ; Table Cape, Tasmania (*T. Woods*) ; Oamaru Formation (Eocene) Broken River, New Zealand (*Hutton*).

Explanation of Plates.

Plate VII.

Fig. 1. *Waldheimia pectoralis*, natural sizes. Aldinga. *a* and *b*, two views of an adult shell ; *c* and *d*, id of a young shell.
Fig. 2a-b. *Waldheimia furcata*, natural size. Aldinga.
Fig. 3. *Waldhemia sufflata*, natural size. Surveyor's Point.
Fig. 4. *Terebratulina lenticularis*, much enlarged. Aldinga. *a*, brachial valve ; *b*, lateral view of both valves ; *c*, front view.
Fig. 5. *Terebratula bulbosa*, *a-b*, two views, natural size. Edithburgh.
Fig. 6. *Waldheimia Tateana*, *a-b*, two views of the same specimen, natural size. Aldinga.

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* This species is described as "sub-circular—under the lens radiately striated," and has no analogy with our fossil.

Plate VIII.

Fig. 1. *Waldheimia Macleani.* Blanchetown. *a-b*, two views of the same specimen, natural size; *c*, brachial valve of a young shell, natural size.

Fig. 2. *Waldheimia fimbriata.* Aldinga. *a-b*, two views of the same specimen, natural size.

Fig. 3. *Terebratulina Scoulari.* Blanchetown; *a*, brachial valve natural size; *b*, enlarged view of portion of the same; *c*, slightly enlarged view of the loop of another specimen; *d*, a young shell, slightly enlarged.

Fig. 4. *Waldheimia sufflata*; lateral view of specimen, natural size, plate vii., fig. 3.

Fig. 5. *Terebratula vitreoides*; *a-b*, two views of the same specimen, natural size. Aldinga.

Fig. 6. *Waldheimia Tateana*; *a-c*, three views of a biplicated example, natural size. Aldinga.

Fig. 7. *Terebratulina triangularis*, slightly enlarged; *a-c*, three views of a specimen from Aldinga; *d*, brachial valve from Bunda Cliffs.

Fig. 8. *Waldheimia divaricata*; *a-b*, two views of the same specimen, natural size. Mannum.

Fig. 9. *Waldheimia Johnstoniana*; *a-b*, two views, natural size. Aldinga.

Plate IX.

Fig. 1. *Terebratula subcarnea*; *a-b*, two views of the same specimen, natural size. Bunda Cliffs.

Fig. 2. *Waldheimia Tateana*, natural size. Stansbury.

Fig. 3. *Thecidium australe.* enlarged views. Muddy Creek. *a*, brachial valve; *b*, interior of peduncular valve, a portion of the hinge area has been removed to show the adductor impressions; *c*, lateral view of the specimen, fig. 3*a*.

Fig. 4. *Waldheimia Corioensis*, McCoy (?); natural size. Mannum (?)

Fig 5. *Terebratella pentagonalis*; *a-b*, two views, natural size. Aldinga.

Fig. 6. *Waldheimia insolita*, natural sizes; *a*, from Bunda Cliffs; *b*, from Aldinga.

Fig. 7. *Waldheimia Corioensis*; interior view of the umbonal part of a brachial valve, natural size. Mannum.

Fig. 8. *Terebratella Tepperi.* Muloowurtie; *a-b*, two views of the same shell, natural size; *c*, interior of brachial valve of another specimen, natural size.

Fig 9. *Rhynchonella squamosa*, natural sizes; *a*, fragment of a peduncular valve, R. Bremer; *b*, perfect shell from Aldinga.

1
a
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2
a
b
c
d
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a
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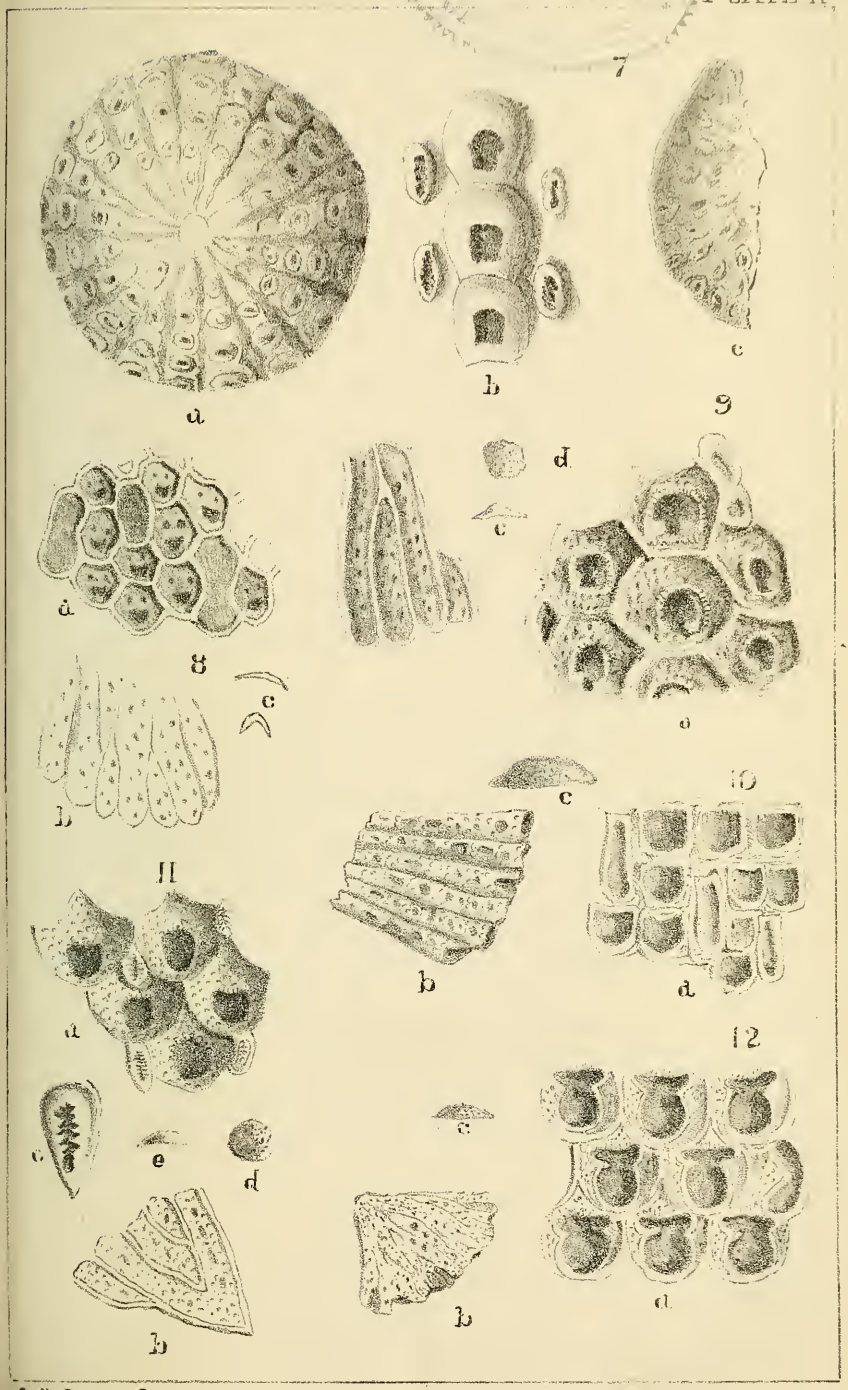
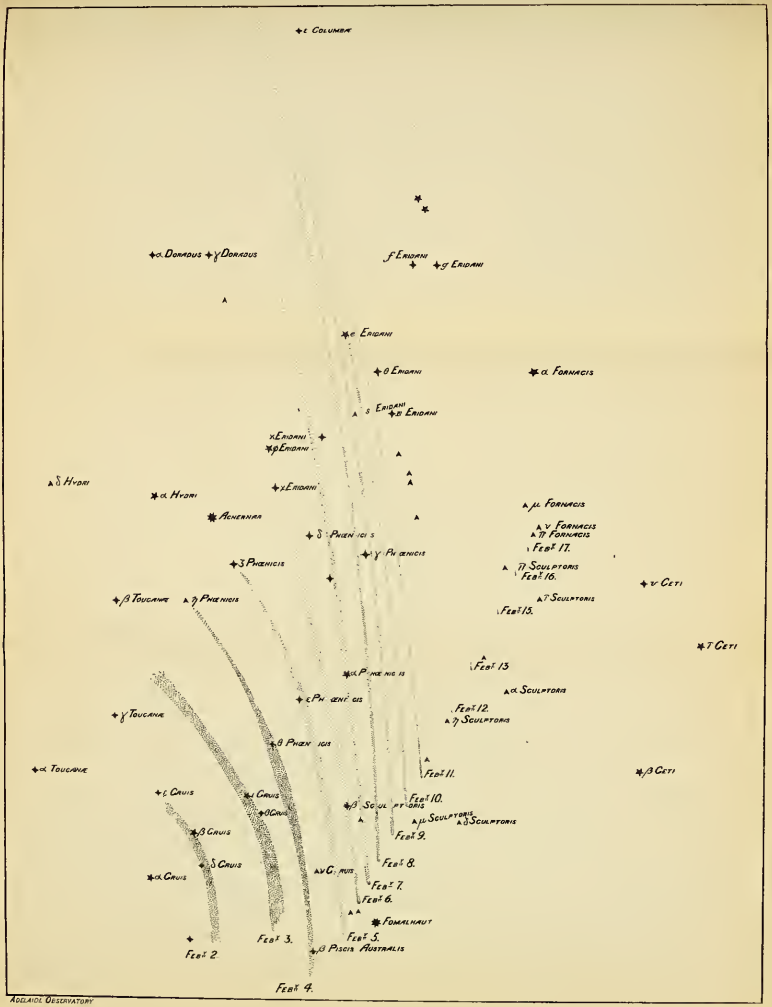
PLATE II.





Adelaide Observatory

Surveyor General's Office, Adelaide Ernest S. Crawford, Photo-lithographer

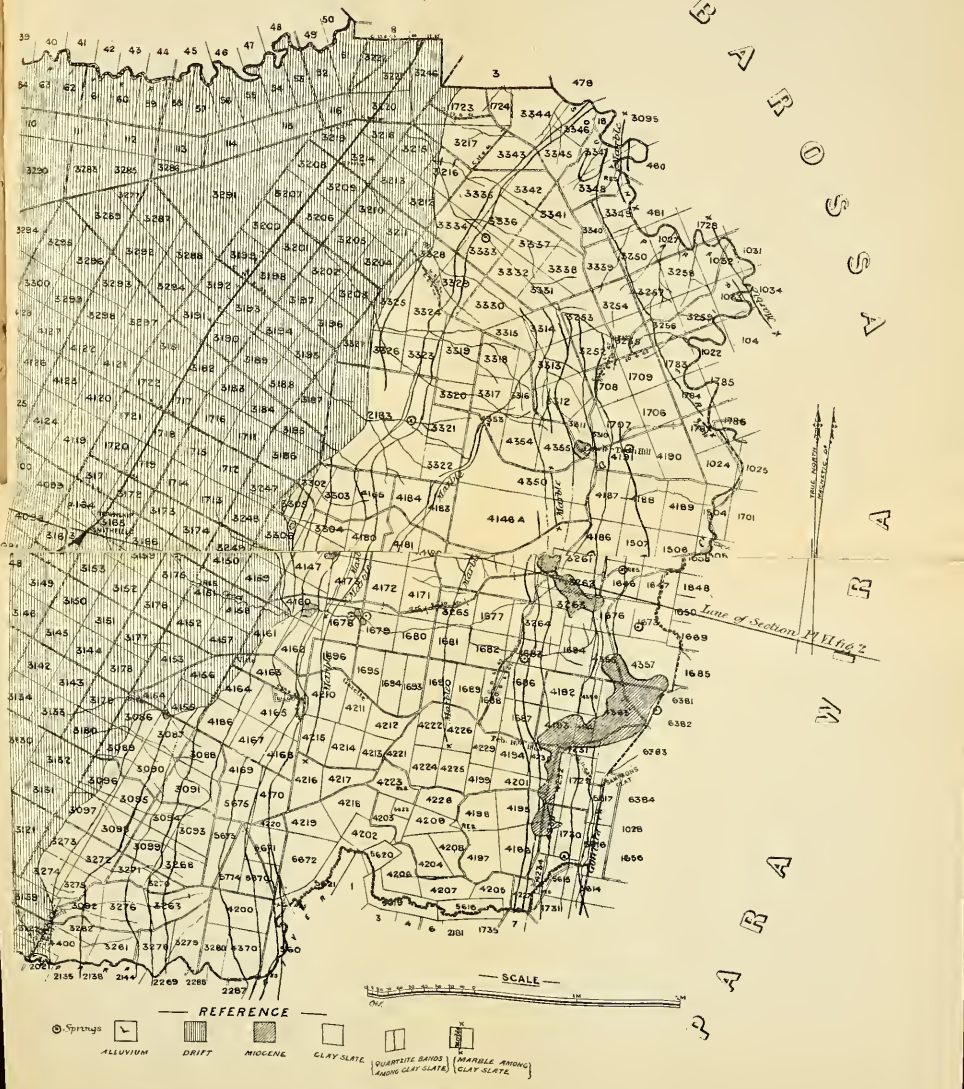
PLATE IV

Hd of Kilkerran
Hd of Maitland
Hd of Cunningham
E
W
Jurassic
Coast
Granitic Series
Jurassic
Triassic
Hornblende Mic. Schists
Sandst. & Congl.
Quartzites
Millan Road
Plagiaclase Porphyre
Ironstone
Gneiss
Sandst. & Congl.
York Valley
Alluvial
Plain
Mission Station
Supposed Tertiaries
Low sandy plain recent
Mouth of Port Perry Peninsula
2 a
2b.
2c.
s
3a.
3 b.
4a.
4 b.
5a.
5b.
5c.
6a.
6b.
Fig. 1.

GEOLOGICAL MAP OF MUNNO PARA EAST

- by -

Gavin Scoular



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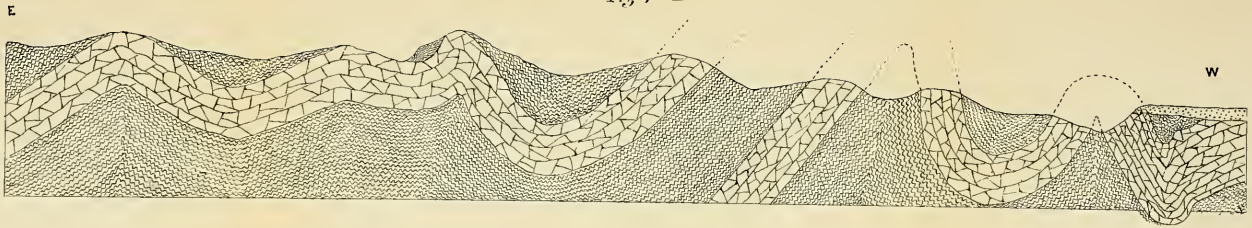

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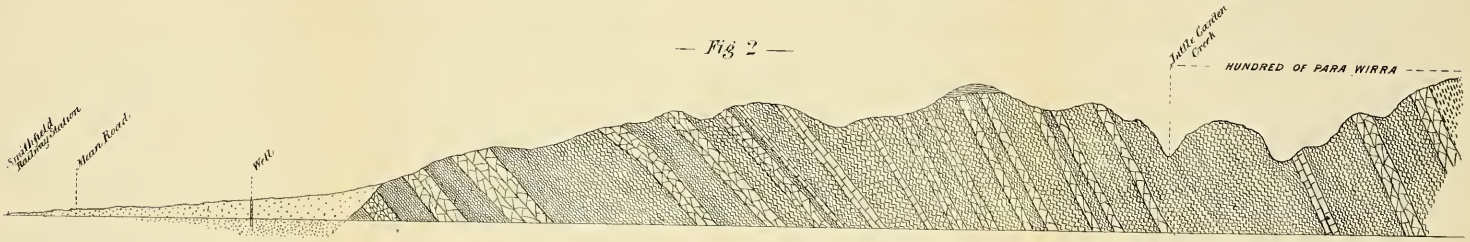

REFERENCE

Drift · Quartzite · Clay Slate · Miocene · Marble · Mica Slate

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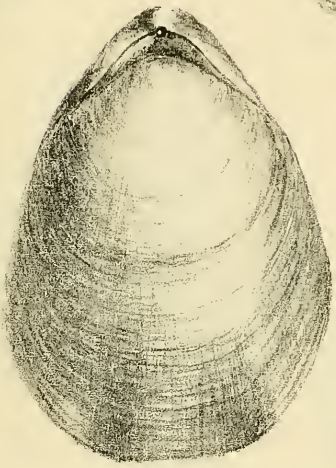
1b

1c

1d

1a

4a



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2a

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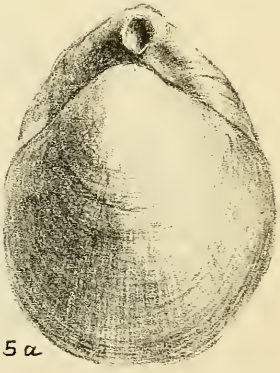
6a

6b



5a

1b.

2a

2b

1c

3b

1a

3d

3c

3a

5b

5a

7d.

7c

7b

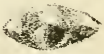
7a

9b.

9a

6b

6a


6c

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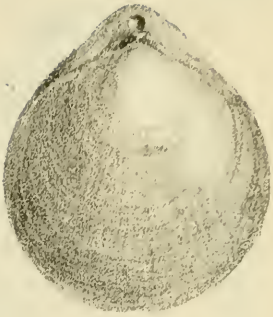

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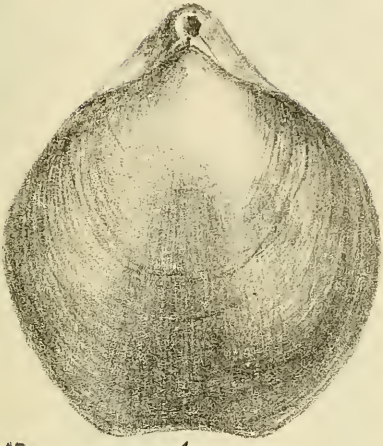

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3 b

3 c

7

6 b

6 a

9 b

9 a

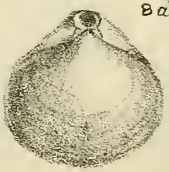
8 c

8 a

10 c

10 b

10 a



8 b

Pl. X.

1 b

2 a

2 b

1 a

5 a

4

3 a

5 b

3 b

5 c

6 c

6 b

6 a

3 d

3 c

6 e

8

7 a

7 b

6 d

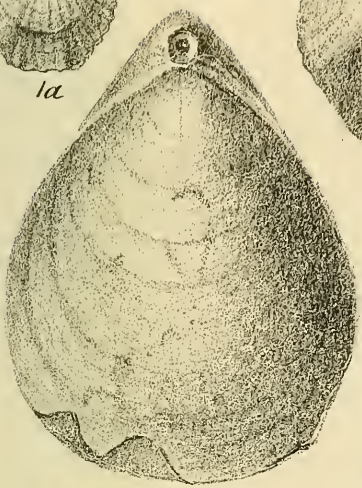
C. H. Strother, Delt.

J. Williams, *Lith.* Adelaide.

1a

1b

1c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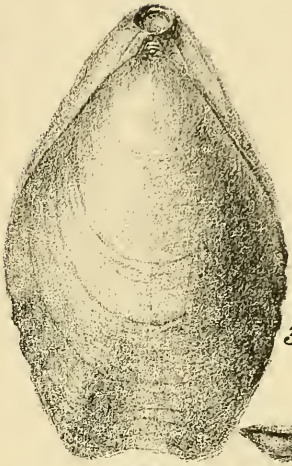
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4

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5a

5b

6a

6b

6c

6d

7a

7b

7c

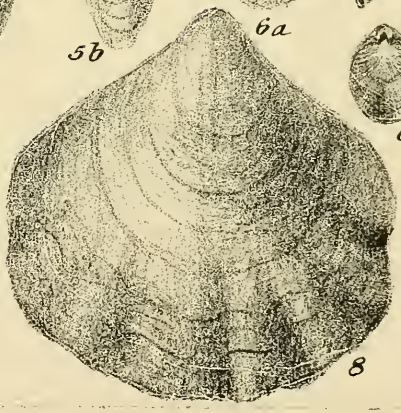
8

Fig. 10. *Terebratella Woodsii.* Table Cape; three views, natural size (copied from drawings of the original by Mr. R. M. Johnston).

Plate X.

Fig. 1. *Waldheimia Vincentiana*, natural size; Surveyor's Point; *a*, brachial valve; *b*, lateral view of both valves.

Fig. 2. *Terebratula Aldingæ*, natural size; Aldinga; *a*, brachial valve; *b*, lateral view of both valves.

Fig. 3. *Magasella Woodsiana.* R. Murray cliffs; *a*, brachial valve; *b*, lateral view, natural size; *c*, interior of brachial valve of another specimen, natural size; *d*, lateral view of loop and septum of another specimen, somewhat enlarged.

Fig. 4. *Waldheimia Corioensis*, natural size. Mannum.

Fig. 5. *Magasella deformis.* Aldinga; *a-b*, different views of the one specimen; *c*, interior view of another. All slightly enlarged.

Fig. 6. *Magasella compta.* Mannum; *a-b*, two views of the same shell; *c*, brachial valve of another specimen; *d*, of a third—all natural sizes; *e*, interior view of a young shell, enlarged.

Fig. 7. *Terebratula vitreoides*, natural size. Blanchetown. *a*, brachial valve; *b*, interior view of the same.

Fig. 8. *Waldheimia Vincentiana*, natural size. Surveyor's Point. Portion of brachial valve removed to show reflected lamellæ of loop.

Plate XI.

Fig. 1. *Waldheimia Garibaldiana*; *a-c*, similar views of three examples; natural sizes. Blanchetown.

Fig. 2. *Waldheimia Taylori*, natural size (copied).

Fig. 3. *Waldheimia grandis*, natural size. Blanchetown.

Fig. 4. id, young example.

Fig. 5. *Magasella Tenisoni*; *a-c*, natural sizes (copied).

Fig. 6. *Terebratulina Davidsoni*; *a-c*, three views of the same shell, enlarged; Mannum; *d*, brachial valve of a very large example, natural size (the loop is preserved in this specimen); Aldinga.

Fig. 7. *Terebratella furculifera.* Aldinga. *a*, brachial valve; *b*, side view of the same shell—natural sizes; *c*, interior of the brachial valve of another specimen.

Fig. 8. *Waldheimia Crouchii*, slightly reduced (copied).

TABLE SHOWING THE GEOGRAPHICAL AND STRATIGRAPHICAL DISTRIBUTION OF THE SPECIES.

SPECIFIC NAMES.	AUTHORS.	LOCALITIES AND HORIZONS.										
		1	2	3	4	5	6	7	8	9	10	11
Terebratula vitreoides	Woods	*					*		*			
Aldingæ	Tate	*										
subcarnea	Tate			*								
bulbosa	Tate		*									
Waldheimia Garibaldiana	Davidson					*	*	*	*	*	*	*
furcata	Tate				*							
divaricata	Tate					*						
Tateana	Woods	*	*						*		*	*
fimbriata	Tate	*										
Johnstoniana	Tate	*										
insolita	Tate	*		*								
grandis	Woods					*	*	*	*			
Crouchii	Woods							*				
McLeani	Tate											*
Vincentiana	Tate		*									
Taylori	Etheridge					?						
Corioensis	McCoy					*				*	*	
pectoralis	Tate	*										
sufflata	Tate	*	*									
Terebratulina Scoulari	Tate	*	*				*				*	*
Davidsoni	Etheridge	*	*			*		*			*	*
lenticularis	Tate	*										
triangularis	Tate	*		*					?			
Terebratella Tepperi	Tate		*									
pentagonalis	Tate	*										
furculifera	Tate	*										
Woodsii	Tate								*			
Magasella compta	Sowerby		*			*		*		*		
Woodsiana	Tate		*		*	*		*			*	*
Tenisoni	Woods							*				
deformis	Tate	*										
Thecidium australe	Tate										*	
Rhynchonella squamosa	Hutton	*	*			*			*		*	
TOTALS	..	16	10	3	2	9	4	7	6	3	8	7

INDEX TO LOCALITIES.

Inferior Beds.—1. Glauconitic limestones at Aldinga.
2. Muloowurtie clays and other lower beds.
3. Chalk rock, Bunda Cliffs.

Middle Beds.—4. Calciferous sands, Aldinga.
5. Lower Murravian.
6. Middle Murravian.
7. Mount Gambier, white limestone.
8. Table Cape.
9. Geelong, &c.

Superior Beds.—10. Muddy Creek.
11. Upper Murravian.

MISCELLANEOUS CONTRIBUTIONS

TO THE

NATURAL HISTORY of SOUTH AUSTRALIA.

ZOOLOGY.

UNIO STURTII, *Adams* and *Angas*, "immense quantities of which are found in the rainwater holes at Umbum, 40 miles south from Peake; natives eat them, but they are anything but palatable." (J. Chandler.) The species was described from specimens collected at Newcastle Waters by the Stuart Trans-continental party.

PHYSA TEXTURATA, *Reeve*; 20 miles from Peake, towards Lake Eyre. (J. Chandler.) (R. Tate.)

CYRENA ANGASI, *Prince*; as large as those obtained from the Reedbeds, exhibited before the Society January 7, 1879. PHYSA ALICÆ, *Reeve*, and UNIO VITTATUS, in the River Onkaparinga, at Noarlunga (Master Molineux). (R. Tate.)

BOTANY.

PLANTS collected by Mrs. Richards, Corr. Memb., at Fowler's Bay:—

PLAGIANTHUS GLOMERATUS, *Benth.*; previously known localities are "south coast" and near Lake Eyre.

ACACIA HOMALOPHYLLA, *A. Cunn.* Reported widely diffused about Fowler's Bay. The ripe pods which accompany the specimens contain seeds attached by a very long and bright red funiculus. The funiculus is doubly folded on the sides of the seed, and is detached with it; and from its brilliant colour is supposed to serve as an attraction to birds, and so assist in the dissemination of the species. The seeds are largely fed upon by *Cacatua Leadbeateri*. The species extends to the oasis of the Bunda Plateau, and northward to the Musgrave Ranges.

SOLANUM HYSTRIX, *R. Br.* Baron F. von Mueller writes:—"I never saw this rare plant before, as it was only once found, *i.e.*, in 1802, at Petrel Bay, by R. Brown." Some of the particulars he asks for I have supplied from personal observation made during my exploration around the Great Australian Bight. It is confined to the sandy ridges covered with mallee

which alternate with the loamy and grassed flats between the head of the Bight and Colona, near Fowler's Bay. I first saw it in flower on January 27, 1879, its large pale blue corolla being in strong contrast with the yellowish green of its foliage; no fruits were then noticed.

Eremophila crassifolia, *F. M.* This is another plant peculiar to South Australia, hitherto known from Mount Greenly, Dombey and Venus Bays, Eyre's Peninsula. The Fowler's Bay specimens represent a small leaved variety.

Thysanotus Baueri, *R. Br.*, previously known from the Adelaide district. (R. Tate.)

Baron F. von Mueller reports the following plants collected by Mrs. Richards at Fowler's Bay and vicinity:—*Sisymbrium trisectum*, *Capsella cochlearina*, *Geococcus pusillus*, *Pimelea serpyllifolia*, *Pomax umbellata*, *Aster calcareus*, *A. magniflorus*, *Echinospermum concavum*, *Hypoxis glabella*, *Arthropodium minus*, *Poa lepida*, and *P. nodosa*.

"Among a few plants collected by Mr. Tietkins, at Pedinga, in the same district, is *Limosella Curdieana*, F. M. I am not sure whether it has been noted as S. Australian. At all events we did not get it from a place so far west. Also *Kochia fimbriolata*, *Lavatera*, *Helichrysum Lawrencella*, *Erodiophyllum*, and *Bulbine semibarbata*." (F. v. M.)

The following places quoted under South Australia in the Flora Australiensis should be transferred to Victoria:—Skipton, Forest Creek, Buffalo Range, Plenty Creek, Fifteen-Mile Creek, Loddon River, and Mount Disappointment.

List of Plants collected by Mr. Chandler at Barrow's and Tennant's Creeks.

A collection of about 90 species of flowering plants, collected by Mr. Chandler while acting as Telegraph Master at the above-named stations, has been submitted to Baron von Mueller, whose determinations here follow. The collection was not made in the interest of botanical science, and in consequence is for a large part not in a good state for specific determination. However, it is of value, as coming from a district which was hitherto unknown botanically, and enables me to enlarge the geographical range of several species. Barrow's Creek is situated within the tropics, lat. 21° 30′, and Tennent's Creek is 147 miles further north.

Of the 49 determined species, 22 are not catalogued for Tropical South Australia by Dr. Schomburgk in his "Flora of

South Australia. They are all the Malvaceæ, *Kochia villosa*, *Petalostylis labicheoides*, *Psoralea patens*, *Glycine elongata*, *Scævola depauperata*, *Tecoma australis*, *Eremophila MacDonelli*, *Cyperus squarrosus*, *C. decompositus*, *Chloris scariosa*, *Eleusine cruciata*, *Triraphis mollis*, *Andropogon laniger*, *Lappago racemosa*, *Perotis rara*, *Pappophorum commune*, and *Eriachne obtusa*. Twelve of the above are recorded by Dr. Schomburgk as occurring in the extratropical parts of the province, but the remaining ten have no place in his lists; they are—*Hibiscus Sturtii*, *Gossypium australe*, *Tecoma australis*, *Cyperus squarrosus*, *Eriachne obtusa*, and *Andropogon laniger*, which are now known to extend into extratropical South Australia; and *Glycine elongata*, *Cyperus decompositus*, *Chloris scariosa*, and *Perotis rara*, which are restricted in Australia to tropical regions. (R. Tate.)

In the following list the letters B., T. prefixed to the specific names refer to the localities Barrow's Creek and Tennant's Creek respectively:—

TILIACEÆ.

T. Corchorus sidoides, *F. M.*

MALVACEÆ.

B. Malvastrum spicatum, *A. Gray;* B. Sida corrugata, *Lindley;* B.T. Abutilon Fraseri, *J. Hooker;* T. Hibiscus Sturtii, *J. Hooker;* B.T. Gossypium australe, *F. M.*

EUPHORBIACEÆ.

B.T. Euphorbia Drummondii, *Boiss.*

AMARANTHACEÆ.

B. Ptilotus obovatus, *F. M.;* B. P. incanus, *Poir.;* B. Achyranthes aspera, *Linné.*

CHENOPODIACEÆ.

B. Kochia villosa, *Lindley*, *var.*

FICOIDEÆ.

B. Trianthema pilosa, *F. M.*

LEGUMINOSÆ.

B. Crotalaria dissitiflora, *Bentham;* B. Psoralea patens, *Lindley;* B. Indigofera hirsuta, *Linné;* B. Glycine elongata, *F. M.;* B. Erythrina vespertilio, *Sw.;* B. Petalostylis labicheoides, *R. Br.*

PROTEACEÆ.

Grevillea Wickhami, *Meissn.* Forster's Range.

CUCURBITACEÆ.

B. Cucumis acidus, *Jacq.;* B. Mukia scabrella, *Arnott.*

LORANTHACEÆ.

B. Loranthus pendulus, *Sieb.*, *var.* cana (L. Quandang, *Lindl.*).

COMPOSITÆ.

B. Pterocaulon sphacelatus, *Benth.*; B. Helichrysum apiculatum, *De Cand.*

GOODENOVIEÆ.

B. Scævola depauperata, *R. Br.*

ASCLEPIADÆ.

B. Cynanchum floribundum, *R. Br.*

CONVOLVULACEÆ.

B. Ipomœa eriocarpa, *R. Br.*
B.T. Evolvulus linifolius, *Linné.*

BIGNONIACEÆ.

B. Tecoma australis, *R. Br.*

MYOPORINCEÆ.

B. Eremophila Latrobei, *F. M.*; MacDonnelli, *F. M.*, *var.*; longifolia, *F.M.*

ACANTHACEÆ.

B. Justicia procumbens, *Linné.*

COMMELINACEÆ.

B. Commelina ensifolia, *R. Br.*

CYPERACEÆ.

B. Cyperus decompositus (?) *F. M.*; C. squarrosus, *Linné.*

GRAMINEÆ.

T. Panicum decompositum, *R. Br.*; B. Setaria glauca, *Beauvoir*; Lappago racemosa, *Willd.*; Andropogon laniger, *Desf.*; Aristida stipoides, *R. Br.*; Anthistiria ciliata, *Linné*; Perotis rara, *R. Br.*; Pappophorum commune, *F. M.*; Triraphis mollis, *R. Br.*; Chloris scariosa, *F. M.*; Eleusine cruciata, *Lamarck*; Eriachne obtusa, *R. Br.*

FILICES.

B.T. Cheilanthus tenuifolia, *Sw.*

PROBABLE CURATIVE PROPERTIES OF MELALEUCA UNCINATA.

Somewhat more than a week ago Mr. Earle, of Pine Point, Muloowurtie, mentioned in conversation to me that he had found accidentally great relief and speedy cure, when suffering from violent catarrh, by crushing between the teeth, and

swallowing the juice of the green leaves of a certain plant occasionally occurring in patches near his residence. He had advised some of his men to try the same remedy and they had experienced the same salutary result. Pointing the plant out to me, I found it to be *Melaleuca uncinata*, R. Br. It is a shrub with a woody stem one to two inches in diameter and from three to eight feet in height. The branches grow straight, upright, and are rather slender; the leaves cylindrical, about one inch long, and pointed; the flowers occur in small brush-like groups around the young twigs, and are whitish; the fruits form closely packed, short cylinders, around the branches; the popular name applied here to this shrub is "broom," and it is quite characteristic of granitic soil. Having made a mental note of the information I resolved to try it myself should occasion arise. The latter days of last week I was much troubled with a violent catarrh, stiff neck, cough, and a difficulty in swallowing. Obtaining a small sprig, I chewed a few leaves (two or three) at irregular intervals. In two days the latter symptoms had altogether disappeared and the catarrh so much abated that it no longer incommoded me. No other remedies were used. In case some of the learned members of the Society would feel inclined to examine the plant chemically in order to determine its probable medicinal character, some specimens accompany this note. The taste shows the existence of a not disagreeable aromatic oil.

J. G. Otto Tepper, Corr. Mem.

Ardrossan, 26th March, 1880.

Appendix to the List of Plants about Ardrossan,

By Mr. Otto Tepper, F.L.S., Corr. Mem.

The species have all been determined by Baron F. von Mueller.

CRUCIFERÆ.

Alyssum minimum, *Pallas*. T.
Cardamine laciniata, *F. M.* C.
Geococcus pusillus, *Drummond* and *Harvey*. C.

POLYGALEÆ.

Comesperma calymega, *Labillardiere*. (?) C.

CARYOPHYLLÆ.

Drymaria filiformis, *Bentham*. T.

PORTULACEÆ.

Claytonia pusilla, *F. M.* Muloowurtie, C.
Claytonia pygmæa, *F. M.* Muloowurtie, P.

FICOIDEÆ.

Trianthema humillima, *F. M.* Maitland road, P.

SALSOLACEÆ.

Atriplex Muelleri, *Bentham.* C.
Atriplex microcarpum, *Bentham.* C.
Suæda maritima, *Dumortier.* Saltmarshes, C.
Kochia humillima, *F. M.* C.

MALVACEÆ.

Plagianthus glomeratus, *Benth.* T. and P.

STERCULIACEÆ.

Thomasia petalocalyx, *F. M.* Maitland sandhills, T.

SAPINDACEÆ.

Dodonæa Tepperi, *F. M.* T, rare.

LEGUMINOSÆ.

Goodia medicaginea, *F. M.* Kilkerran.
Acacia acinacea, *Lindley.* Black Point, Muloowurtie, C.

HALORAGINEÆ.

Loudonia Behrii, *Schlechtendal.* Muloowurtie and Maitland sandhills, T. (?).

MYRTACEÆ.

Leptospermum lævigatum, *F. M.* Muloowurtie sandhills and coast, and Black Point, G.
Eucalyptus dumosa, *A. Cunn.* T. and P.

UMBELLIFERÆ.

Hydrocotyle rugulosa, *Turczaninow.* Maitland sandhills, T.
Didiscus pusillus, *F. M.* Muloowurtie, P.

COMPOSITÆ.

Podolepis Siemsseuia, *F. M.* Muloowurtie, P.
Helichrysum obtusifolium, *Sond.* P.
Centipeda Cunninghami, *F. M.* T. and P.

STYDIDIEÆ.

Stylidium calcaratum, *R. Br.* Maitland sandhills.

GOODENOVIEÆ.

Scævola linearis, *R. Br.* Maitland, T. and P.

EPACRIDEÆ.

Styphelia Richei, *Labill.* Black Point, C.

LOGANIACEÆ.

Mitrasacme paradoxa, *R. Br.* Muloowurtie, P.

MYOPORINEÆ.

Eremophila viridiflora, *F. M.* P.

ORCHIDEÆ.

Thelymitra carnea, *R. Br.* Yorke Valley, T., rare.
Lyperanthus nigricans, *R. Br.* Maitland sandhills, T.
Acianthus exsertus, *R. Br.* P.
Caladenia carnea, *R. Br.* T. and P.

LILIACEÆ.

Chamæscilla corymbosa, *F. M.* Yorke Valley, T., rare.

RESTIACEÆ.

Centrolepis aristata, *Roem.* and *Schult.* Maitland sandhills, T.
Centrolepis aristata, *var.* pygmæa. Muloowurtie, P.

CYPERACEÆ.

Lepidosperma viscidum, *R. Br.*, C.
Schœnus Brownii, *J. Hooker.* Maitland sandhills, T.
Schœnus Tepperi, *F. M.* G.

GRAMINEÆ.

Sporabolus Virginicus, *Kunth.* Winulta, P.
Danthonia nervosa, *J. Hooker.* Yorke Valley, T.

FILICES.

Cheilanthes distans, *R. Brown.*

Geococcus pusillus is remarkable for being strongly suspected of having two widely different forms. The principal one pushes its fruit *below* the soil while perfecting and ripening; the other, generally a weaker plant, has an upright stalk, and resembles very much a *Cardamine*. It is not very common, and occurs generally where an accumulation of decayed animal matter has enriched the soil, as in the camping place of cattle.

Comesperma calymega is not yet fully identified, as a doubt exists whether it may not prove to be *C. defoliatum*, F. M. It grows among the grass near the coast, near Rogue's Point, Muloowurtie.

Drymaria filiformis is quite new to the province, having hitherto only been known from the Irwin River, W. Australia. It is an elegant little plant, resembling a *Claytonia*, and was found flowering in the latter part of September, in the mallee scrub, near the Kalkabury road, five miles from Ardrossan.

Of similar interest is *Trianthema humillima*, which, as Baron F. v. Mueller informs me, had formerly only been known from one locality, between the Rivers Darling and Lachlan. It occurs here on low ground on the Maitland road near the boundary of the Hundred of Cunningham, and is most probably

the smallest of all phanerogamic plants of the world; the tallest specimen scarcely exceeds one-eighth of an inch. It has not been seen, though looked for, at any other locality.

Kochia humillima is also new to the province, its proper habitat being Victoria. It is a small plant, and is becoming very rare through the cropping of the sheep.

Plagianthus glomeratus occurs only in the northern part of the Hundred and beyond, but occasionally a stray specimen is seen near Ardrossan. It is a much smaller plant than its congener, *P. spicatus*. The latter only flourishes once, and once only, on newly-burnt soil, the seed then becoming latent, till another fire starts it into growth. Acres of dead stalks, five to seven feet high, may be seen in fertile parts of the scrub, and not a single young plant comes up for years.

Dodonæa Tepperi, F. v. M., is a new species, distinguished by its dense low growth, very small leaves, and a quadrilateral speckled fruit. Only one plant has as yet been found on a stony hillside, near Ardrossan.

Goodia medicaginea is new for the locality, and was obtained from Kilkerran by Dr. Engelhardt, of Maitland.

Acacia acinacea has only been seen here on the low plain at Black Point, but was formerly observed in great plenty near Monarto and at Truro on stony hills. It has a silvery grey leaf.

Hydrocotyle rugulosa had not before been known out of W. Australia, but Baron F. v. Mueller remarks, has perhaps been overlooked and taken for *H. capillaris*. It occurs sparingly in the mallee scrub of Muloowurtie and the sandhills near Maitland.

Helichrysum obtusifolium has been only obtained in one specimen near Ardrossan. Its leaves appear to die off when in full bloom.

Stylidium calcaratum is new for the locality. It is a very small plant, scarcely a quarter of an inch long, but the stalk is about one and a half inches, and the flower very large for its bearer. It was profusely abundant for the space of a few square yards near the sandhills N. of Maitland, while round about not any could be discerned.

Thelymitra carnea is one of the rarest of our orchids, and also new for the locality, it having before only been found about Mount Lofty. The specimen was found growing under the protection of an old brush fence in Yorke Valley. Under similar circumstances *Chamæscilla corymbosa* was found.

Lyperanthus nigricans has nowhere else been observed by me than among the sandhills near Maitland. It is a beautiful orchid, that obtained its specific name from drying perfectly black. *Acianthus exsertus* and *Caladenia carnea* occur often in

society, but the former only and exclusively on granite soil under *Melaleuca uncinata*.

Schœnus Tepperi, F. v. M., is a new species, occupying rocky dry hillsides and summits, chiefly in the neighbourhood of granite, where it flourishes best.

Cheilanthes distans, R. Br., has only been found in one spot of a few yards square growing on a metamorphosed hornblendic schist, altered by contact with granite into a jaspery, green and white banded stone.

GEOLOGY.

Rock formations and minerals in the vicinity of Peake, C.A., being a report by Professor R. Tate on specimens forwarded by Mr. J. Chandler.

Pre-Silurian.—The hill country is constituted principally of *micaceous* and *hornblendic slates*, but *talcose* slate also occurs, and *diorite* is abundant. The quartz veins in these metamorphic rocks yield an abundance of *micaceous iron-ore*, and specimens of calcite with copper pyrites and purple copper and green carbonate of copper have been obtained from them.

Jurassic.—A dense gray earthy fossiliferous limestone from Peake contains the following species of fossils, but in a bad state of preservation:—*Monotis Barkyli*, Moore; *Cytherea Clarkei*, Moore; *Pleuromya* sp.; *Lingula* sp.

A similar fossiliferous rock is reported by Mr. Chandler, on the information of Mr. Cameron, the manager on Mr. A. B. Murray's run at Cootanoorina, 30 or 40 miles west from Peake, to have been discovered in that place in a well 30 feet deep on the banks of the Peake Creek. "The rock is a mass of fossilised mussel shells, which are about the size of a man's hands closed and pressed together."—J. C. The fossils here referred to are casts of *Cytherea Clarkei*. Mr. R. Beetson communicates fossils obtained by him at the foot of Mount Margaret. They are *Belemnites* sp., *Dentaluim* sp., *Chione* sp., and a small compressed, sub-equilateral *Pleuromya*. He assures me that the Jurassic rocks occupy the low country, and that the "spring-mounds" are based upon them.

Desert Sandstone.—Among the specimens probably derived from beds of this age are:—

Brown hydrous oxide of iron-boxes, "found on the stony ridges eight miles north of Peake, under Mount Kingston Range; no springs in immediate vicinity." *Natural marbles* or *stone bullets*, which are terms that may appropriately be applied to spherical masses of quartzose sand cemented by brown

hydrous oxide of iron, "found in great plenty on the rises on which the previously-mentioned specimens were taken." The marbles are solid throughout, and do not exhibit any signs of having acquired their spherical shape by rolling, particularly as several examples present prominently projecting fragments of quartz.

From the table-lands specimens of chalcedonic quartz and jasper stones "are found scattered about amongst the loose surface quartz on the flats four miles west of this."

Recent.—Deposits from the springs at Peake. "The surface covering of the flat around the spring" is a fine sand cemented by calcareous matter; exterior surface of specimen botryoidal. A dense calcareous tuff "from spring flats at Peake." A red ochre with gypsum "found near the springs." A cellular calcareous tuff forms "the top crust of the mound-springs." An opalescent quartz is "a common specimen taken from the springs."

The above specimens prove most conclusively that the mounds are composed of mineral matter deposited from the water of the springs, and do not owe their form to volcanic action, as is popularly supposed, and has been insisted upon by some observers (see Trans. of this Society, 1879, p. *l.*)

Tourmaline.—A large prismatic piece, about $1\frac{1}{2}$ inches diameter, from Mount Boothby, 90 miles north of Alice Springs, where it is said to be abundant. "If I am not mistaken, I have seen plenty of it, only in smaller pieces, running in veins through quartz near the Barrow's Creek Telegraph Station." J. C.

Mica, in large transparent plates. "In large quantities in the MacDonnell Ranges." J. C.

Magnetic iron ore, "locality uncertain, but suspected to have been found in this neighbourhood." J. C.

Hard kaolin clay, "obtained from a high table land hill eight miles south-west from Charlotte Waters. A quarry of this was opened there, and the station was built of it; it also makes excellent tobacco pipes." J. C.

Graphic Granite.—Mr. Otto Tepper forwards a specimen of graphic granite consisting of red felspar and translucent quartz arranged prismatically, so that in a cross section the felspar appears to be interspersed with graphic lines of quartz. He writes:—"It was discovered on the north side of the Maitland-road, on the eastern incline of Yorke Valley ridge, Yorke's Peninsula, forming a dyke of a few yards in width between the gneissic rock. The strike of the dyke is indistinct,

but appears to be S.E. and N.W. The scrub, composed of *Melaleuca uncinata*, is very dense there, hindering all observations."

Sections of strata traversed by wells made for and communicated by Mr. W. Fowler, at Yarrow, in the Hundred of Clinton, on the west side of head of St. Vincent's Gulf:—

No. 1. Section 315, Hundred of Clinton, in creek. Height of surface, 78 feet above high-water, determined by spirit level.

	Feet.	Remarks.
1. Red loam and gravel ...	78	Brackish water
2. Rock, an impure mixture of sand and lime ...	6	Contains roots of trees, evidently of mangroves
Total	84	

"This well is nearly one mile from the sea, but the water found on it is at exactly the same level as the sea at present. It also shows that the sea must have been at the same level as now when the mangrove roots, now fossil, were growing." W. Fowler.

No. 2. Section 313, half-a-mile north-west of No. 1. Surface 136 feet above high-water by spirit level.

	Feet.	Remarks.
1. Red clay	30	
2. Soft sandstone... ...	100	Water found at 130 feet
3. Very fine running sand	15	Sinking stopped by inflow of water, not fresh, but good enough for sheep
Total	145	

No. 3. Section 275, in creek, one and a-half miles north of No. 2. Surface 165 feet above high water. Very brackish water was reached at 165 feet from surface. The nature of strata exactly as in No. 2 well.

Well section, at about ten to eleven miles west from Lake Torrens, near Whittata, communicated by Mr. H. Lattorff:—

	Feet.
1. Bright red sandy soil	3
2. Soft red clay	15
3. Darker red sandy clay	27
4. Fine yellow reddish sand	13
5. Whitish sandy clay with ironstone boulders ...	12
6. Bright yellow, white, blue, and then red clay-slate	58
Total	128

Below 128 feet, at which saltwater was met with, there occurs a hard red slate containing mica.

Mr. Lattorff writes, July 24, 1880, that the rainfall during the four seasons he has been at Whittata has fallen between four and seven inches per annum; that the rain does penetrate the soil for more than four feet on the average, except in favoured places, where we have found damp ground to seven feet, or when saltwater lies near the surface. This is the result arrived at from observations made in the course of trial sinkings and excavating dams to the number of about forty.

A Scheme for the Organization and Direction

OF THE

EFFORTS OF AMATEUR COLLECTORS.

EDITED BY THE PRESIDENT AND HON. TREASURER.

Extracts from Regulations of the Society.

1. The Royal Society of South Australia, being desirous of encouraging the study of Natural Science, is prepared to direct the efforts of amateur collectors, and to receive from them observations and specimens—undertaking to record original observations, and when practicable to identify specimens. Those willing to engage in a systematic correspondence are requested to communicate with the *Hon. Secretary, Adelaide.*

2. Persons co-operating with the Society in recording Natural Science phenomena in this province be entitled "Local Correspondents."

3. A list of local correspondents be appended to the "List of Members of the Society," published in its Transactions.

4. Approved communications from local correspondents and members, and records of new facts, not being of the nature of a formal paper, be published in the Transactions of the Society under the title of "Miscellaneous Contributions to the Natural Science of South Australia," and that a reprint of the same be transmitted to each local correspondent.

NOTE.—Eminent Australian naturalists have consented to act as referees in their respective departments.

INSTRUCTIONS.

1. Not fewer than two specimens of each kind of plant should be forwarded; also of other objects, particularly shells, insects, crabs, polyzoa, and fish, when not too bulky. In the case of those plants and animals in which the sexes are in different individuals, one example at least of each sex should be sent.

2. Each specimen, or each set of specimens should be distinctively numbered; and the duplicate specimens retained by correspondent should be numbered correspondingly.

3. Notes on the habits, habitat, station, food, native and colonial names, and other particulars should be recorded at the time of observation. The memorandum referring to any specimen should be docketted with a number corresponding with that affixed to the specimen.

The life history of nearly all Australian animals is meagre, and there is little fear that the information which you can afford is of "no use," because "too little," or is, apparently, "what every one knows." Plants from districts far inland, or recently settled, are very desirable. Do not exclude from your local collection any object merely because it occurs frequently or appears insignificant.

4. Parcels not exceeding one pound in weight, nor of greater dimensions than two feet by one foot, may be forwarded by post (suitably protected against breakage or crushing), if directed as follows:—

Natural History Specimens, without Letter.

From —(add name and address)

To the

Director of the Natural Science Section,

Royal Society, Adelaide.

The rate of postage is one penny for each *two ounces.*

5. If a parcel be too large for transmission by post, describe contents and suggest mode of transit to the Director, whose advice should be awaited, so that unnecessary expense may be avoided.

6. As it is very desirable that correspondents should get beyond mere collecting, the Society will endeavour to obtain information touching works suitable for study or reference, and in other respects will help them in completing and perfecting the scientific results of their observations.

7. Applications for a money grant should state the amount required and the mode and object of the proposed outlay.

SHORT DIRECTIONS

FOR

COLLECTING AND PRESERVING.

MAMMALS.—*Skins* may be dressed with arsenical soap or alum and salt (see Appendix). *Skeletons* (the skulls are most important) may be cleaned by the agency of ants. For this purpose the skeletons, coarsely divested of their flesh, are placed in a box and set over an ant's nest, holes in the box being made for the passage of the insects. *Skulls* may be prepared by cautious boiling and subsequent removal of the flesh. *Bodies of smaller kinds* may be preserved in spirit or other preserving fluid after removal of intestines.

BIRDS.—Skins and skeletons as in the case of mammals. Preserve skulls, breastbones, feet, and eggs.

REPTILES, as in the case of mammals; they may be killed by being violently thrown on soft ground, or by a knife stab at the junction of the head and neck.

FISH.—Smaller kinds may be preserved in spirit. Larger reptiles and fish may be cut through lengthways, and the half skin glued or sewn on pasteboard.

Note the contents of the stomach or crop of the foregoing to determine the food.

INSECTS may be sought for under the bark of living trees, under stones, about and in the carcases of decaying animals, on the leaves and flowers of herbs, shrubs, and trees, and in pools and streams. Some must be sought for at night by the aid of a lantern. Most may be captured by hand. Small forceps are useful to pick up insects, especially the noxious ones; but some others, as butterflies, may be caught by a muslin bag-net, and the aquatic species may be taken by the same means.

Delicate specimens may be temporarily pinned to a layer of cork or agave stem, in the crown of a tall hat. A captured insect, not being a butterfly or moth, should be killed by

placing it in a wide-mouthed bottle of a size convenient for the pocket, in the bottom of which has previously been placed some pieces of cyanide of potassium *(highly poisonous)*, covered by a layer of blotting-paper or fine sawdust. The bottle must be securely corked or stoppered. In the absence of cyanide of potassium, the insects may be killed by immersion in spirit, and beetles by dipping them into hot water. Small beetles, ants, &c., must be gummed on card circles. A great many insects, particularly beetles, may, after careful drying, be packed in layers with fine sawdust in a tin box; the lid of the box should be made secure against the ingress of those small insects which are so destructive to entomological specimens.

Butterflies and moths may be killed by a pinch between the fingers just beneath the insertion of the wings. The insect its wings having been carefully brought together, is to be placed in an envelope of paper (of the stiffness of stout writing paper) of the form here described:—Take a square piece of paper, fold it diagonally, but so as to make the upper triangular piece a little smaller than the lower; place the butterfly between the folds, and now turn over and press down the overlapping margins of the lower triangle. The size of the original square must be determined by the size of the insect, so as to make the envelope just large enough to prevent the insect shifting. When dry the envelopes may be packed in layers in a tin box.

Spiders and the like.—Preserve in spirit, glycerine, or preservative fluid. Note habits, kind of web, nests. The colours should be described in life; the special points for description are the number and position of the eyes, jaws, relative length of legs, shape of breast-plate, male palps, and epigyne of female.

Crabs, crayfish, shrimps, and the like; and Starfish, and sea-urchins should be immersed in spirit for a minute, or just long enough to destroy life, and afterwards dried rapidly by artificial heat, below that of the boiling point of water. In the case of the salt water forms it would be well to wash them in fresh water before treating them with spirit. Small specimens may be kept in the spirit or preservative fluid.

Marine Shells.—Endeavour to procure them with their animals. Some cling to rocks, others beneath loose stones, or burrow in sand or mud between tide marks. Extreme low tides should be availed of to secure those which habitually inhabit the region just beyond low tide mark; those still further out can only be procured by dredging, but are occasionally cast up on the beach during storms. Dead shells

accumulate towards high water mark. Particular circumscribed areas, at certain times, may be seen on close examination to be strewn with small shells, some microscopic; this *shell sand* is in great request, and should be gathered by lightly scraping it together by a lath or knife-blade; transfer to a bag. The coarser material may be removed by sifting. On sprinkling the shell sand on the palm of the hand, there should appear few grains of sand, the bulk should be small entire shells.

Snail shells, not having a natural polish, may be cleaned as follows:—Place in cold water, boil, drain off water, add cold water, and remove animal by a bent pin or cobbler's awl. Take care to return to the interior of the shell the horny or stony lid which closes the aperture of the shell when the animal is withdrawn within it; plug in the *operculum*, as this is called, with cotton wool. Shells having a natural polish should not be boiled, but may be buried in sand, and after the animal has rotted away, washed with cold water.

The animals of mussel and cockle shells may be killed by immersion in boiling water. Taken from the water, the valves gape widely; dry inside and outside, close the valves by the pressure of the thumb and fingers of one hand, and wind a moistened thread or tape two or three times around the shell and tie. Small examples of snails and other shells may be dried in sand. A few living specimens of each kind should be preserved in spirit. Homœopathic bottles are useful to keep small specimens distinct.

Land Snails abound most among craggy rocks of the hill country, and may be found among the crevices of rocks or under large stones, or collections of damp leaves.

Freshwater Snails and mussels occur in most waters, some living on the aquatic plants, others buried in the bottom mud. They may be collected by hand, but more conveniently by means of a perforated tin-pannikin fixed to the end of a stick. After scraping over the bottom with this dredge, wash by shaking in water, examine residue, and transfer shells to box or bottle.

The after treatment for the land snails, freshwater snails, and mussels is the same as for sea snails and cockles.

Polyzoa are thrown up on sea beaches, especially from deep water; some have the aspect of delicate seaweeds, others of corals. The horny flexible kinds are generally grey or light-brown, reddish if alive, curl inwards on drying. Individual cells require hand magnifier to bring out details. Many of this class of animals are parasitic on seaweeds (especially on root-like bases), and encrust shells and stones. Information as to the live animals much needed.

Parasites may be found on the fur or feathers of live mammals and birds, or attached to reptiles and fish. Internal parasites (particularly desired) live in the liver, stomach, intestines, or other organs of animals.

Plants are best preserved by drying. The apparatus for drying flowering plants, ferns, and mosses consists of a few smoothly-planed boards, newspapers, and coarse, stout, unsized paper, or blotting-paper. Upon one of the boards place a few folds of newspaper, a sheet of drying paper, on which the plants are to be carefully laid out, then another sheet of drying paper, and again more folds of paper, and so on. The number of sheets of paper to be placed between each sheet of plants will depend on the one hand, on the thickness and humidity of the specimens; on the other hand, on the quantity and quality of the paper one has at command. On the top sheet place a board, and upon that stones, bricks, or other weights, from 20 lbs. upwards, according to the consistency of the specimens. It is useful, also, to have extra boards or pasteboards the size of the paper, to separate thick plants from thin ones, wet ones from those nearly dry, &c. Another day's collection may be arranged in the same way on the top board, and another board used and the weights replaced. After a few days the specimens should be shifted into fresh sheets, and pressure continued until all their moisture is dissipated Care must be taken that the paper used is well dried. In dry weather, and by the use of coarse, stout paper, the majority of plants require only one shifting. Succulent plants may be dipped in boiling water all but the flowers, preparatory to drying. Heaths and other plants which are apt to shed their leaves during drying may be treated in the same manner. Thick stems should be pared down.

Plants for preservation should be carefully selected, so as to show the various parts proper to them, not only in flower, but in fruit (both young and mature). Small plants should be gathered with their roots; the root-leaves of larger herbs should be secured, and others may be cut or folded into requisite lengths. Plants may be gathered into a tin box; but better suited for this climate is a portable collecting and drying apparatus, which consists of sheets of stiff paper, 14 inches by 9 inches, or more, separately folded between boards, or open wooden frames, with crossbars, connected by straps towards the ends, and having a third passing lengthwise around. The portfolio is a little bulkier and heavier to carry than the collecting-box, but its advantages are much greater, and its employment is imperative in the case of plants whose flowers close or wither soon after gathering; and though it is advisable to transfer the plants from it to the ordinary drying press on

reaching home, yet neglect to do so is not attended with such disastrous results as with the collecting-box.

A slip of writing-paper, on which the date, place, and situation in which the specimen was gathered should be attached, and note should be taken of the stature, habit, colour of the flowers, or of any other particulars which the specimen itself cannot supply, or which may be lost in the process of drying. A ready mode of attaching a label to a plant is making a loop in the middle part of the paper by two longitudinal cuts, through which the stalk or other part of the plant is passed.

The perfectly dried plants may be packed up in bundles, with a single sheet of paper between each layer. They may be placed very closely on the sheets, but not in more than one layer on each sheet, and care must be taken to protect the bundles by sufficient covering from the effects of external moisture or the attacks of insects.

The Society being desirous of collecting material for a report on the introduced plants, seeks information in reference to each plant as follows:—

Whether a weed of cultivated or pasture ground.
Whether an escape from cultivation.
Date of its appearance.
The extent of its spread.
Whether on the increase or decrease.
The conditions most favourable for its propagation.
Its utility or inutility.
Duration of flowering.
Its common name.

Seaweeds should be searched for among the rock-pools between tide-marks. Deep water algæ are occasionally cast up after storms, but they should be rejected if not fresh; they may be gathered into a linen bag. Empty collecting-bag into a basin of sea-water; select the best and cleanest plants and rewash. To Mount.—Float the seaweed in water and slip under it a piece of smooth drawing or fine white cartridge paper, arrange the specimen on the paper, and carefully remove from the water, press and dry between blotting paper. Thin plates of perforated zinc to support the mounting paper when in water, and to facilitate its removal therefrom, will prove useful. Most seaweeds will adhere to the mounting paper, but if it be wished to have them loose use calico instead of paper.

Geology.—Rock specimens should be broken off from rocks *in situ*, and not from rolled stones or boulders, though much useful information may be gained by proving them to belong to some distant locality. Take from interior parts unaffected by weather.

Fossil bones when friable may have something of their original condition restored to them by repeated soakings in a weak solution of glue.

Fossils in the form of casts or moulds are for the most part valueless.

The most useful form of hammer is one of solid steel, short and squared at the head, and the other side drawn to a point; the handle should have inches marked on it. A chisel is indispensable for cutting out fossils from rock surfaces. Old files make excellent chisels.

Specimens of rocks, minerals, and fossils should be separately wrapped in paper. Delicate fossils should be packed in sawdust or bran.

Natural or artificial exposures of rocks should be measured in detail, the magnetic direction of the face of the section, and the amount of inclination of the beds to be noted. Take an example of each bed, numbering it correspondingly with the defining number in your description. Examine weathered surface for fossils, and state from what stratum of the section they have been obtained, and the frequency of their occurrence.

The following particulars relating to well sinking or borings are much desired by the Society. "Forms," to be filled up, will be supplied on application :—

SITE OF BORING OR WELL.
(To be described as accurately as possible.

HEIGHT OF SURFACE of ground above the sea at low water (stating whether found by spirit level, or barometer, or estimated.)

SIZE OF HOLE
and how sunk.

Depth in feet below the Surface.		Nature of Strata.	*Remarks.
From	To		

* In remarks column refer to numbered specimens of strata and fossils found therein, which may accompany this statement. Also give depth at which water was found, stating whether fresh, salt, brackish, or mineral, and give any other information which may be of scientific or economic value.

Signature of Observer—

Date—

N.B.—The full equipment of a naturalist comprises a great variety of articles; but, under any circumstances, he considers the following indispensable:—Pencil, note-book, knife, string, pins, paper for wrapping, and match-box.

APPENDIX.

Recipes for Dressing Skins.

(1).—*Arsenical soap.*

Arsenious acid	4 ozs.
Soap	4 ozs.
Carbonate of potash	4 drams.
Camphor	1 oz.
Water	3 ozs.

Cost of ingredients about 2s. 6d.

Mix under a gentle heat. When used form a lather with any spirituous liquor and apply with a brush.

(2).—*A substitute for the above.*—Alum 3 parts, common salt 1 part, pure water 24 parts, by weight.

Recipes for Preservative Fluids.

(3). *Methylated spirit*, at 50 deg. over proof; price in Adelaide 7s. per gallon; may be diluted with an equal quantity of water.

(4).—*Wickersheimer's preservative fluid*—

Alum	10 drams	Dissolve in 300 drams of boiling water.
Common salt	2½ drams	
Saltpetre	1·2 drams	
Carbonate of potash ...	6 drams	
Arsenious acid ...	1 dram	

After cooling and filtering, add to every ten pints of this solution four pints of glycerine and one pint of methylated spirit. Cost of ingredients about 5s. per gallon.

Specimens that have been immersed for some days or weeks, according to their size, will keep out of the solution, and will remain plastic.

(5).—*Goadby's solution*, a substitute for spirit, may be employed for soft-bodied animals, without shells or bones—

Salt	4 ozs.	Add boiling water two quarts, well stir together, and filter.
Alum	2 ozs.	
Corrosive sublimate ...	4 grains	

(6).—*Glycerine.*—The disadvantageous property of corrugating and decolorising animal structures possessed by spirit is obviated by the use of glycerine. Retail price, 4s. 6d. per lb.

(7).—*An aqueous solution of alum*, in the proportion of alum 1 part, pure water 16 parts, preserves animal substances very well for a short time; all the parts retaining their natural conditions to some extent, except the bones and shells, which are acted on by its acidity. Retail price, 9d. per lb.

(8).—*Strong salt and water* may be used in the absence of any of the above, for quite temporary purposes.

ERRATA ET CORRIGENDA.

Vol. I.

Transpose 4 and 6 on Plate 1.

Vol. II.

Page 1, line 11, *dele* australis, Phillips.
" lxvii., line 11, *for* Pleocine *read* Pliocene.
" 67, line 19 from bottom, *for* our *read* one.
" 109, line 2, *for* insoluta *read* insolita.
" 125, line 9 from bottom, for *Stignoderma* read *Stigmodera*.
" 134, Bulimus sinistrorsus is changed to B. Myoporinæ. (See vol. iii., p. 104).

Vol. III.

" 35, line 12, *for* Phytolacceæ *read* Phytolaccaceæ. Transpose line 40 to the bottom.
" 44, line 3, *for* diotia *read* dioica.
" 54, line 21, *for* trachspermus *read* trachyspermus; line 25, for *Sand.* read *Gaud.*
" 66, line 17, *dele* comma after Mukia.
" 69, line 10, *for* 529 *read* 429.
" 71, line 10, *for* 540 *read* 549; line 20, *for* 860 *read* 560.
" 80, line 9, *for* 200 *read* 209.
" 86, line 2 from bottom, and page 87, line 1, *for* Aristidia *read* Aristida.
" 88, line 28, *for* 688 *read* 663.
" 130, line 4 from bottom, for *vicosa* read *viscosa*.

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TRANSACTIONS AND PROCEEDINGS

AND

REPORT

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